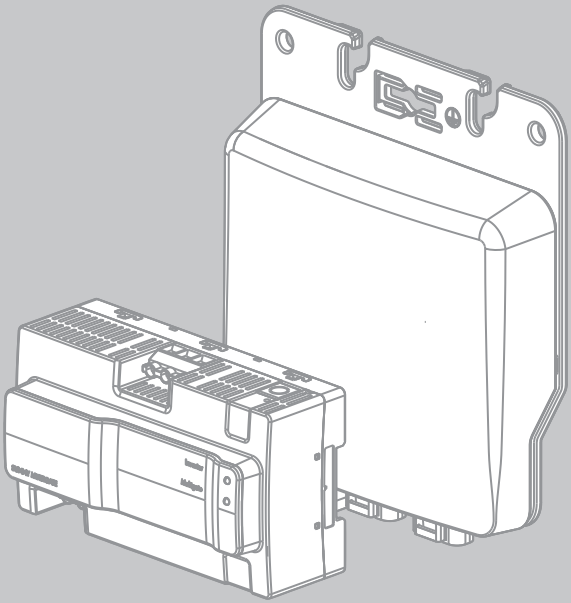
Installation Manual

SUNNY BOY 240-US
SUNNY MULTIGATE-US



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AMERICAN ENGLISH

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Important Safety Instructions

SAVE THESE INSTRUCTIONS

This manual contains important instructions for the following products:

- Sunny Boy 240-US (SB 240-US-10)
- Sunny Multigate-US (Multigate-US-10)

This manual must be followed during installation and maintenance.

The product is designed and tested in accordance with international safety requirements, but as with all electrical and electronic equipment, certain precautions must be observed when installing and/or operating the product. To reduce the risk of personal injury and to ensure the safe installation and operation of the product, you must carefully read and follow all instructions, cautions and warnings in this manual.

Warnings in this document

A warning describes a hazard to equipment or personnel. It calls attention to a procedure or practice, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the SMA equipment and/or other equipment connected to the SMA equipment or personal injury.

Symbol	Description
⚠ DANGER	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	NOTICE is used to address practices not related to personal injury.

Warnings on this product

The following symbols are used as product markings with the following meanings.

Symbol	Description
	Warning regarding dangerous voltage The product works with high voltages. All work on the product must only be performed as described in the documentation of the product.
	Beware of hot surface The product can become hot during operation. Do not touch the product during operation.

Symbol	Description
	Observe the operating instructions Read the documentation of the product before working on it. Follow all safety precautions and instructions as described in the documentation.

General Warnings

⚠ WARNING

All electrical installations must be made in accordance with the local and *National Electrical Code*® ANSI/NFPA 70 or the *Canadian Electrical Code*® CSA C22.1. This document does not and is not intended to replace any local, state, provincial, federal or national laws, regulations or codes applicable to the installation and use of the product, including without limitation applicable electrical safety codes. All installations must conform with the laws, regulations, codes and standards applicable in the jurisdiction of installation. SMA assumes no responsibility for the compliance or noncompliance with such laws or codes in connection with the installation of the product.

The product contains no user-serviceable parts.
For all repair and maintenance, always return the unit to an authorized SMA Service Center.

Before installing or using the product, read all of the instructions, cautions, and warnings in this manual.

Before connecting the product to the electrical utility grid, contact the local utility company. This connection must be made only by qualified personnel.

Wiring of the product must be made by qualified personnel only.

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1 Information on this Document

Validity

This document is valid for the following device types:

- SB 240-US-10 (Sunny Boy 240-US)
- Multigate-US-10 (Sunny Multigate-US)

Target Group

This document is intended for qualified persons. Only persons with the appropriate skills are allowed to perform the tasks described in this document Skills of Qualified Persons.

Additional Information

Links to additional information can be found at www.SMA-Solar.com:

Document title	Document type
Micro Inverters in Sunny Portal	User Manual
Sunny Explorer	User Manual

Symbols

Symbol	Explanation
i	Information that is important for a specific topic or goal, but is not safety-relevant
☐	Indicates a requirement for meeting a specific goal
☑	Desired result
✖	A problem that might occur

Nomenclature

Complete designation	Designation in this document
SMA America Production, LLC	SMA
SMA Solar Technology Canada Inc.	SMA
SMA Speedwire	Speedwire
PV system	PV system
Sunny Boy 240-US*	Sunny Boy, inverter, micro inverter, product
Sunny Multigate-US	Sunny Multigate, communication unit, product
Inverter which is located at the beginning of the PV system and is connected directly to the Sunny Multigate via the AC cable	First inverter

Complete designation	Designation in this document
Inverter which is located at the end of the PV system and not directly connected to the Sunny Multigate	Last inverter

* The terms "Sunny Boy", "Sunny Boy 240-US", "micro inverter" and "inverter" are synonymous in this document. For simplicity, the general term "inverter" is often used.

2 Safety

2.1 Intended Use

Sunny Boy 240-US

The Sunny Boy is a micro inverter for PV systems that converts the direct current from a PV module into grid-compliant alternating current. The alternating current generated is fed into the utility grid via the Sunny Multigate-US.

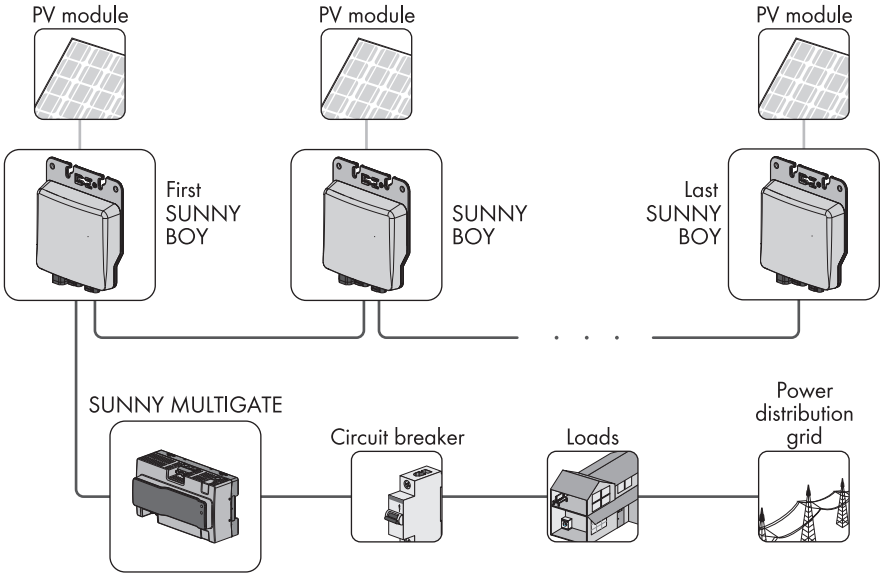


Figure 1: Design of a PV system with Sunny Boy 240-US and Sunny Multigate-US

The product is suitable for indoor and outdoor use.

The Sunny Boy must only be connected to one PV module. The PV module used must be compatible for use with the Sunny Boy. The Sunny Boy must be operated with the Sunny Multigate.

All components must remain within their permitted operating ranges at all times.

The product must only be used in countries for which it is approved or released by SMA and the grid operator.

Use this product only in accordance with the information provided in the enclosed documentation and with the locally applicable standards and directives. Any other application can cause personal injury or property damage.

Alterations to the product, e.g. changes or modifications, are only permitted with the express written permission of SMA. Making unauthorized changes will void the warranty and warranty claims and will normally result in invalidation of the operating permit. SMA shall not be held liable for any damages caused by such changes.

Any use of the product other than that described in the Intended Use section does not qualify as appropriate.

The enclosed documentation is an integral part of this product. Read and observe the documentation and keep it in a convenient place for future reference.

The type label must remain permanently attached to the product.

- Do not connect any loads between the Sunny Boy and the Sunny Multigate.
- Do not connect any loads between the individual Sunny Boy inverters.
- Do not open the lid of the Sunny Boy.
- Only mount the Sunny Boy on the framework mounted on the roof directly under the PV modules or on the wall.
- Do not mount the Sunny Boy directly on the module frame.
- Do not mount the Sunny Boy in areas containing highly flammable materials or gases.
- Do not mount the Sunny Boy in potentially explosive atmospheres.

Sunny Multigate-US

The Sunny Multigate is a communication unit and forms the electrical connection point of the PV system with a maximum of twelve micro inverters to the utility grid. The Sunny Multigate is connected between the micro inverters and the utility grid to feed the alternating current of the micro inverters collectively into the utility grid.

The Sunny Multigate must always be installed in a dust-tight and water-tight industrial enclosure complying with the fire protection class 5VA and pollution degree 3. For indoor use, an industrial enclosure Type 1 with back panel complying with UL50 is required. For outdoor use, an industrial enclosure Type 3 with back panel complying with UL50E is required.

The product must only be used in countries for which it is approved or released by SMA and the grid operator.

Use this product only in accordance with the information provided in the enclosed documentation and with the locally applicable standards and directives. Any other application can cause personal injury or property damage.

Alterations to the product, e.g. changes or modifications, are only permitted with the express written permission of SMA. Making unauthorized changes will void the warranty and warranty claims and will normally result in invalidation of the operating permit. SMA shall not be held liable for any damages caused by such changes.

Any use of the product other than that described in the Intended Use section does not qualify as appropriate.

The enclosed documentation is an integral part of this product. Read and observe the documentation and keep it in a convenient place for future reference.

The type label must remain permanently attached to the product.

- A maximum of twelve micro inverters can be connected to the Sunny Multigate.
- No loads must be connected between the Sunny Boy and the Sunny Multigate.
- No loads must be connected between the Sunny Multigate and the circuit breaker.
- The grounding conductor of the AC cable from the inverter must be connected to the Sunny Multigate.
- The grounding conductor of the utility grid must be connected to the grounding conductor terminal of the Sunny Multigate.
- The Sunny Multigate must not be opened.

2.2 Skills of Qualified Persons

The tasks described in this document may only be performed by qualified persons. Qualified persons must have the following skills:

- Knowledge of how an inverter works and is operated
- Training in how to deal with the dangers and risks associated with installing and using electrical devices and systems
- Training in the installation and commissioning of electrical devices and systems
- Knowledge of the applicable standards and directives
- Knowledge of and adherence to this document and all safety precautions

2.3 Safety Precautions

This section contains safety precautions that must be observed at all times when working on or with the product.

To prevent personal injury or property damage and to ensure long-term operation of the product, read this section carefully and follow all safety precautions at all times.

⚠ DANGER

Risk of electric shock due to high voltages

In the live components of the inverter and the Sunny Multigate, high voltages are present that can cause fatal electric shocks if touched.

- Do not open the inverter.
- Do not open the Sunny Multigate.
- Do not touch any live components of the inverter.
- Do not touch any live components of the Sunny Multigate.
- Before working on the inverter, ensure that no voltage is present and wait five minutes.
- Before working on the Sunny Multigate, ensure that no voltage is present and wait five minutes.
- Follow the instructions precisely.
- Observe the safety messages on the inverter and the Sunny Multigate.

⚠ DANGER

Risk of electric shock due to ground fault

If a ground fault occurs, parts of the system may still be live. Touching live components can lead to lethal electric shocks.

- Prior to touching any components, always disconnect the inverter from any voltage sources as described in this document (see Section 9, page 57).
- Prior to touching any components, always disconnect the Sunny Multigate from any voltage sources as described in this document (see Section 10, page 59).

⚠ DANGER

Risk of electric shock due to damaged devices

Operating a damaged inverter or Sunny Multigate can lead to hazardous situations that result in lethal electric shocks.

- Only operate the inverter and the Sunny Multigate provided that they are in safe and full working order.
- Regularly check for visible damage.

⚠ WARNING

Risk of burns from hot surfaces

The surfaces of the inverter and the Sunny Multigate can get very hot. Touching the surface can result in burns.

- Mount the inverter in such a way that it cannot be touched inadvertently.
- Do not touch hot surfaces.
- Wait ten minutes for the surface to cool sufficiently before performing any work on the inverter.
- Observe the safety messages on the inverter and the Sunny Multigate.

NOTICE

Damage to the inverter due to moisture and dust intrusion

Dust or moisture intrusion can damage the inverter and impair its functionality.

- Seal all inverter pin connectors with the appropriate plugs or protective caps.

NOTICE

Damage to the Sunny Multigate from moisture and dust intrusion

Dust or moisture intrusion can damage the Sunny Multigate and impair its functionality. The Sunny Multigate must always be installed in an industrial enclosure in accordance with UL50E. This will ensure that the Sunny Multigate is protected against dust and moisture and is suitable for indoor and outdoor operation.

- For indoor use, always install the Sunny Multigate in a Type 1 industrial enclosure with pollution degree 3.
- For outdoor use, always install the Sunny Multigate in a Type 3 industrial enclosure with pollution degree 3.

NOTICE

Damage to the Sunny Multigate type label due to the use of cleaning agents

- If the Sunny Multigate is dirty or dusty, you can clean the enclosure, the ventilation slots, the type label, and the LEDs. Prior to cleaning it, disconnect the Sunny Multigate from voltage sources (see Section 10, page 59). Then you can clean the Sunny Multigate with a dry brush.

NOTICE

Damage to the inverter type label due to the use of cleaning agents

- If the inverter is dirty, you can clean the enclosure, the enclosure lid, and the type label using only water and a cloth.

3 Scope of Delivery

Check the scope of delivery for completeness and any externally visible damage. Contact your distributor if the scope of delivery is incomplete or damaged.

Sunny Boy

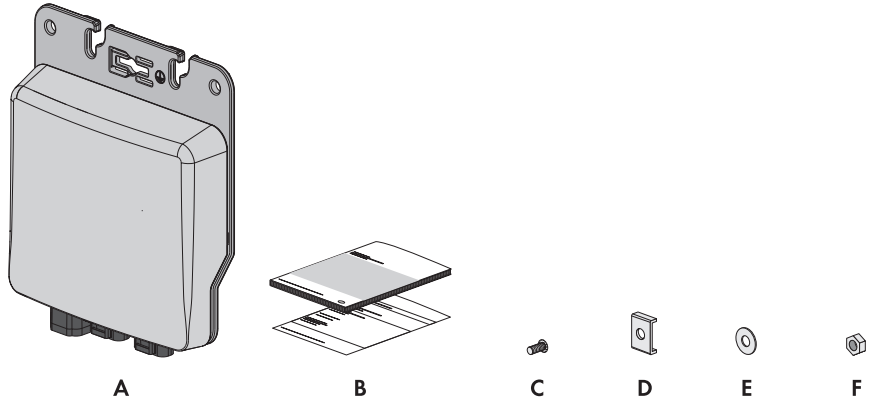


Figure 2: Components included in the scope of delivery of the inverter

Item	Quantity	Designation
A	1	Inverter
B	1	Supplementary sheet for the inverter, Production Test Report
C	1	Grounding bolt
D	1	Clamping bracket for equipment grounding
E	1	Washer for equipment grounding
F	2	Hexagon nut for equipment grounding

Sunny Multigate-US

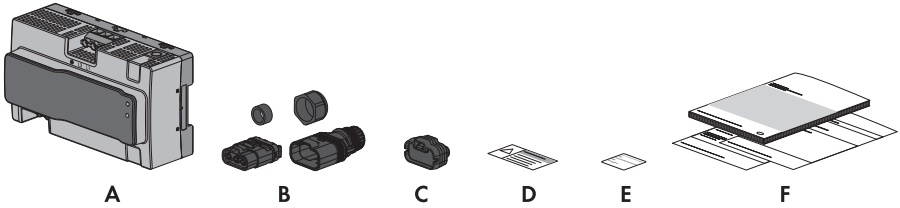


Figure 3: Elements included in the scope of delivery of the Sunny Multigate

Item	Quantity	Designation
A	1	Sunny Multigate
B	1	AC field plug: insulator, enclosure, seal, screw connection
C	1	Protective cap for the unused AC pin connector on the last inverter*
D	1	Warning labels for attaching to the industrial enclosure
E	1	Label with registration ID (RID) and identification key (PIC) for registration in Sunny Portal**
F	1	Installation manual for Sunny Boy and Sunny Multigate, mounting overview

* Last inverter: in this document, the inverter that is located at the end of the PV system and not directly connected to the Sunny Multigate but only to one other inverter, is referred to as the "last inverter". An AC pin connector remains unused on the last inverter and must be closed with a protective cap.

** Keep this label with your access data for registration in Sunny Portal. The access data can be found on the Sunny Multigate type label.

AC Cable and DC Plug

Figure 4: Components included in the scope of delivery of the AC cable and the DC plug

Item	Quantity	Designation
A	1	AC cable with two connectors for connecting two inverters or for connecting the first inverter to the AC field plug*
B	1	DC plug with two DC connectors**

* First inverter: The inverter that is located at the beginning of the PV system and is directly connected to the Sunny Multigate via the AC cable is called "first inverter" in this document. AC cables are plugged into both AC pin connectors at the first inverter.

** The DC connectors illustrated may deviate from your order.

4 Product Description

4.1 Sunny Boy

The Sunny Boy is a micro inverter for PV systems that converts the direct current from a PV module into grid-compliant alternating current. The alternating current generated is fed into the utility grid via the Sunny Multigate-US.

Symbols on the Inverter

Symbol	Explanation
	Equipment Grounding Terminal

4.2 Sunny Multigate

The Sunny Multigate is a communication unit and forms the electrical connection point of the PV system with a maximum of twelve micro inverters to the utility grid. The Sunny Multigate is connected between the micro inverters and the utility grid to feed the alternating current of the micro inverters collectively into the utility grid.

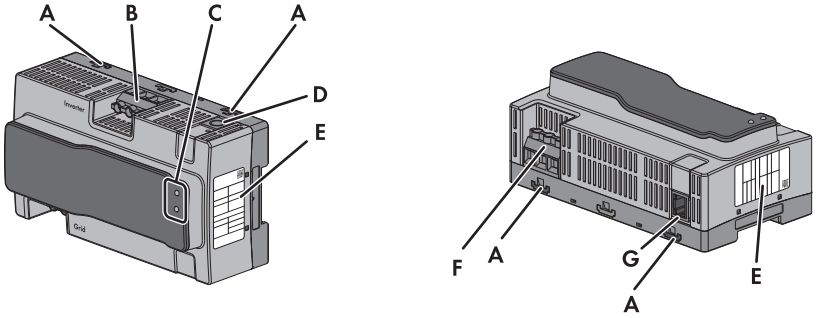


Figure 5: Design of the Sunny Multigate

Item	Designation
A	Press-out brackets for mounting with screws
B	Screw terminal for AC input (inverter) Labeling: Inverter
C	LEDs The upper LED indicates the operating state of the inverter. The lower LED indicates the operating state of the Sunny Multigate. Depending on the operating state, the LEDs are glowing green, red or orange, or are off (see Section 11.1 "LED Signals on the Sunny Multigate", page 60).
D	Interface for optional communication

Item	Designation
E	Type label
F	Screw terminal for AC output (utility grid) Labeling: Grid
G	Pin connector for connecting the network cable (RJ45)

4.3 Type Labels and Stickers

Sunny Boy

The type label uniquely identifies the inverter. The type label is located on the right-hand and left-hand sides of the enclosure. On the left-hand side of the enclosure, you will find the warnings and safety precautions. On the right-hand side, you will find the following product-specific data:

- Device type (Model)
- Serial number (Serial No.)
- Date of manufacture
- Device-specific characteristics

You will require the information on the type label to use the product safely and when seeking customer support from the SMA Service Line.

Label with Inverter Serial Number

A type label with the serial number of the inverter is located at the rear of the Sunny Boy. This label is detachable. To enable clear identification of the inverters of a PV system, e.g. under fault conditions, this label can be applied to the enclosed mounting overview.

Sunny Multigate

The type label provides a clear identification of the Sunny Multigate. The type label is located on the right-hand side of the enclosure. You will find the following information on the type label:

- Device type (Model)
- Serial number (Serial No.)
- Date of manufacture
- Registration ID (RID) for registration in Sunny Portal
- Identification key (PIC) for registration in Sunny Portal
- Device-specific characteristics

You will require the information on the type label to use the product safely and when seeking customer support from the SMA Service Line.

Symbols on the Type Labels

Symbol	Explanation
	Observe the documentation. Observe all the documentation supplied with the product.

Symbol	Explanation
c UL us LISTED	Evaluated to the requirements of the Underwriters Laboratories Standard for Safety for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, UL 1741.
FC	FCC designation The product complies with the requirements of the applicable FCC standards.
	WEEE designation Do not dispose of the product together with the household waste but in accordance with the locally applicable disposal regulations for electronic waste.

4.4 Communication

Communication between Inverter and Sunny Multigate

The inverter is connected to the Sunny Multigate via the AC cable. The communication and data transmission between the Sunny Multigate and the inverters takes place via a Powerline interface.

Communication between Sunny Multigate and Other Communication Products

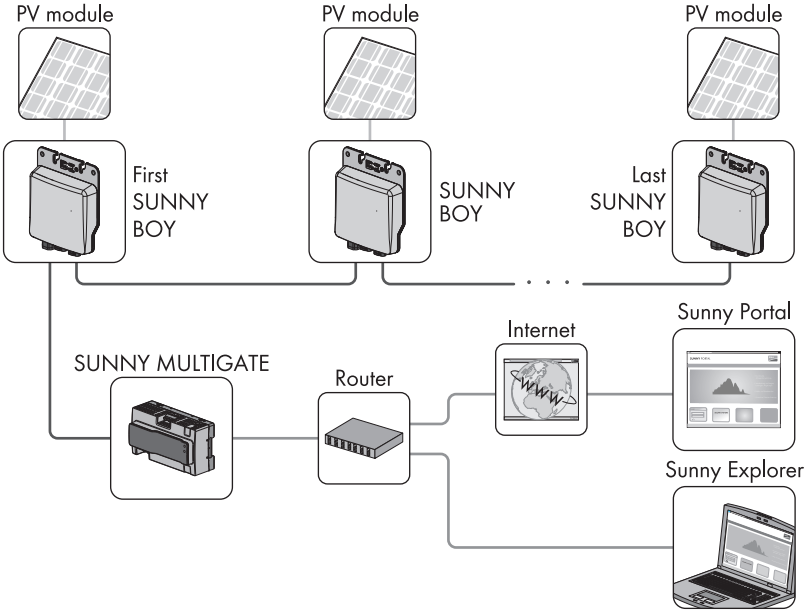


Figure 6: Example of a PV system with micro inverters and Sunny Multigate with communication via Speedwire/ Webconnect

Communication between the Sunny Multigate and other SMA communication products (e.g. Sunny Explorer, Sunny Portal) takes place via Speedwire/Webconnect. Speedwire is a type of communication based on Ethernet. You can connect the Sunny Multigate to your network via Speedwire. Webconnect enables data exchange between Sunny Multigate and Sunny Portal. In order to establish a connection to Sunny Portal, the Sunny Multigate must be connected to a router or modem with Internet connection and be integrated into the local network. To enable data exchange between Sunny Multigate and Sunny Portal, you must register the PV system in Sunny Portal (see Section 8.2, page 53). If you do not want to use the Webconnect function, you can deactivate it in Sunny Explorer (see Section 8.6, page 54).

5 Mounting

5.1 Requirements for Mounting the Inverter

Requirements for the mounting location:

⚠ WARNING

Danger to life due to fire or explosion

Despite careful construction, electrical devices can cause fire.

- Do not mount the product in areas containing highly flammable materials or gases.
- Do not mount the product in potentially explosive atmospheres.

⚠ WARNING

Risk of burns from hot surfaces

The surface of the inverter can get very hot. Touching the surface can result in burns.

- Mount the inverter in such a way that it cannot be touched inadvertently.
- Do not touch hot surfaces.
- Wait ten minutes for the surface to cool sufficiently before performing any work on the inverter.
- Observe the safety messages on the inverter.

☐ The mounting location must be inaccessible to children.

☐ The inverter must be mounted on the framework underneath the PV modules, on the roof or on a solid support surface (e.g. concrete, brickwork). In living areas, ensure that the support surface is not plasterboard or similar. When in operation, the inverter makes noises which can be perceived as a nuisance.

☐ When mounting on the framework, the mounting position should preferably be in the center of the PV module. This will ensure a longer electrical endurance of the inverter.

☐ The mounting location must be suitable for the weight and dimensions of the inverter (see Section 13.1 "Sunny Boy 240-US", page 71).

☐ The mounting location should not be exposed to direct solar irradiation. Direct solar irradiation can increase the operating temperature of the inverter. As a result, the inverter reduces its power output.

☐ The ambient temperature must be between −40 °C and +65 °C (−40 °F to +149 °F). This ensures optimal operation of the inverter.

Dimensions for mounting:

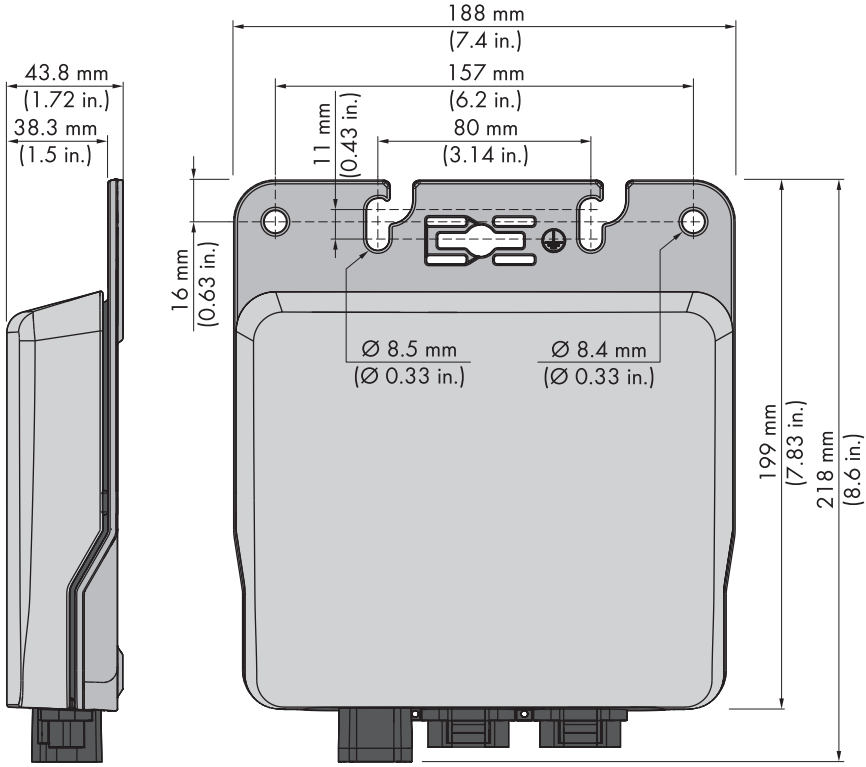


Figure 7: Dimensions of the inverter and the drill holes for mounting

Recommended clearances:

- ☐ When using an AC cable of length 1.40 m (4.6 ft.): min. 50 mm (2.0 in.) to max. 1.10 m (3.6 ft.)
- ☐ When using an AC cable of length 2.0 m (6.6 ft.): min. 50 mm (2.0 in.) to max. 1.70 m (5.6 ft.)
- ☐ Greater distances between two inverters can be bridged using the AC field plug (see Section 6.6.1 "Assembling the AC Field Plug", page 41).
- ☐ Observe recommended clearances to the inverters or other objects.

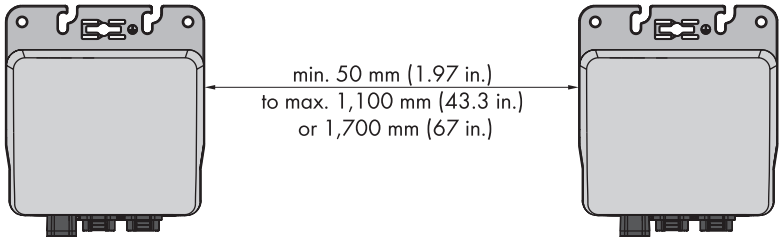


Figure 8: Recommended clearances

Minimum Clearance between Inverter and PV Module Bottom Side:

NOTICE

Damage to the PV module due to insufficient clearance between the inverter and the PV module bottom side

For roof mounting, the clearance from the inverter to the bottom side of the PV module must be at least 30 mm (1.2 in.). This will prevent the grounding bolt from damaging the PV module.

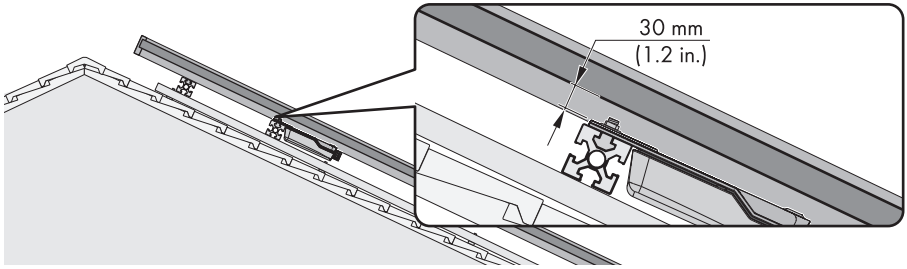


Figure 9: Minimum clearance of the inverter to the bottom side of the PV module

Permitted Mounting Position:

⚠ DANGER

Risk of electric shock due to ingress of moisture

- During mounting, make sure that the connection area of the inverter remains dry.
  As soon as the connector and protective cap are plugged in, the connection area will be protected from moisture ingress. This means that the inverter complies with Type 4X.

5.2 Mounting the Inverter

5.2.1 Mounting the Inverter on the Roof

⚠ WARNING

Risk of death or serious injury when working on the roof

There is a risk of falling or slipping when working on the rooftop. Observe the applicable accident prevention regulations for work on rooftops.

- Before stepping on the rooftop, ensure the load bearing capacity of all parts subjected to load.
- In accordance with the accident prevention regulations, a safety harness must be worn or a safety scaffold used.
- Use a fall protection.

When mounting the inverter on the roof underneath the PV modules, proceed as follows.

You can mount the inverter with the back panel or with the enclosure lid to the roof. SMA recommends mounting the inverter with the enclosure lid to the roof. This will allow for better heat dissipation. Observe the minimum clearance of the inverter to the PV module.

i Information on the figures in this section

The figures show the recommended mounting option for the inverter with the lid facing the roof. The procedure for mounting the inverter with the back panel facing the support surface is identical and is not depicted in the figures in this section.

i Position of the inverter

In order to ensure optimum operation and long electrical endurance of the inverter, install each inverter centered under the respective junction box of the PV module.

Additionally required mounting material (not included in the scope of delivery):

- ☐ The required fastening material must be selected according to the profile rail used.
- ☐ The mounting material must be made of stainless steel.
- ☐ Diameter of the screws: max. M8 (0.3 in.)

NOTICE

Damage to the PV module due to screws being too long

The length of the screws must be suitable for the clearance between the inverter and the PV module bottom side.

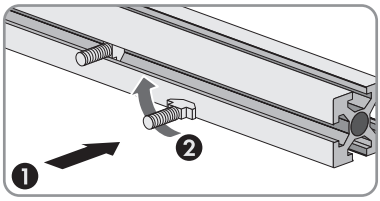
- Make sure that the PV module is not damaged by the screws being used.

There are several options for attaching the inverter to the framework on the roof. In the following example, mounting with T-head bolts is described.

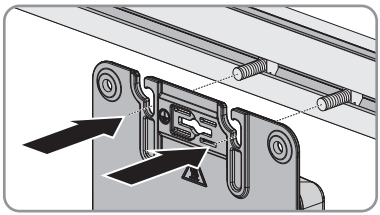
Procedure:

1. Keep the supplied mounting overview at hand for the allocation of the inverters to the PV modules.

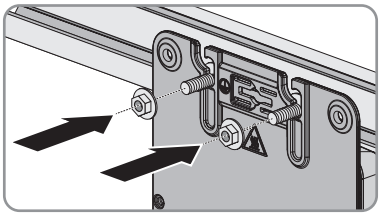
2. In case the connection area points upwards during mounting, make sure to protect the plugs and pin connectors against ingress of moisture.
3. Remove the label with the inverter serial number from the inverter and attach it to the corresponding position in the mounting overview included in the delivery.
   Useful hint: You can note down the inverter serial number in the mounting overview.
4. Insert the T-head bolts into the rail and turn by 90°. This will firmly anchor the screws in the rail.



5. Position the inverter on the anchored screws. Insert the screws into the oblong holes in the enclosure as far as the required fastening point.



6. Attach the inverter using suitable washers and nuts.



7. Ensure that the inverter is securely in place.
8. Ground the inverter enclosure (see Section 5.3, page 27).

5.2.2 Mounting the Inverter on the Wall

To mount the inverter on the wall, proceed as follows.

Additionally required mounting material (not included in the scope of delivery):

- ☐ The mounting material must be made of stainless steel.
- ☐ Two screws suitable for the support surface
- ☐ Two washers suitable for the screws
- ☐ Two screw anchors suitable for the support surface and the screws

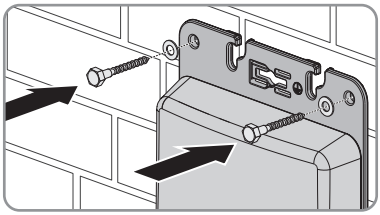
Procedure:

1. **⚠ WARNING**

   Risk of electric shock if electric cables and other supply lines are damaged by drilling

   - Before drilling, ensure that there are no electric cables and supply lines in the wall that could be damaged.

2. Mark the position of the drill holes using the holes in the enclosure. For this, use the two outer holes or the two oblong holes in the middle.
3. Drill the holes and insert the screw anchors.
4. Align the inverter with the drill holes and attach it using suitable screws and washers.



5. Ground the inverter enclosure (see Section 5.3, page 27).

5.3 Grounding the Inverter Enclosure

To connect the equipment grounding conductor, you must ground the inverter enclosure.

You can ground each inverter separately or connect several inverters to one grounding conductor. The grounding conductor of the utility grid must be connected to the grounding conductor terminal of the Sunny Multigate.

Information on the figures in this section

The figures show an example of the mounted inverter with the lid facing towards the roof. The procedure for grounding a mounted inverter with the rear side facing towards the roof or the wall is identical and is therefore not shown as a figure in this section.

Overview

Figure 10: Material for equipment grounding included in the scope of delivery

Position	Designation
A	Grounding bolt
B	Clamping bracket
C	Washers
D	Hexagon nuts

Ground the inverter enclosure as follows:

Cable requirements:

- ☐ Only use copper cables.
- ☐ Use only cables made of solid wire.
- ☐ Cross-section of the equipment grounding conductor: 4 mm² to 16 mm² (12 AWG to 6 AWG)

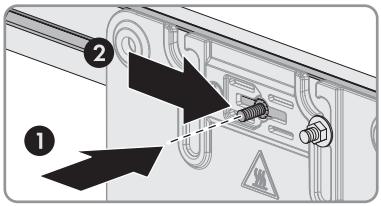
NOTICE

Damage to the PV module due to insufficient clearance between the inverter and the PV module bottom side

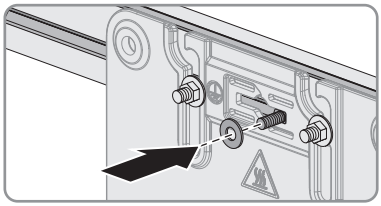
For roof mounting, the clearance from the inverter to the bottom side of the PV module must be at least 30 mm (1.2 in.). This will prevent the grounding bolt from damaging the PV module.

Procedure:

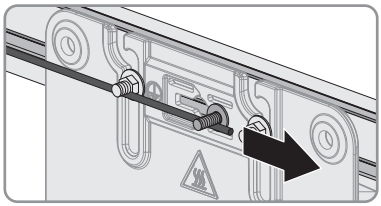
1. Insert the grounding bolt into the hole with the bolt head facing the support surface (e.g. rail) and push it to the right-hand stop.



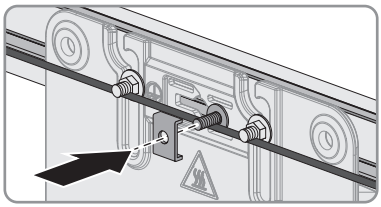
2. Position a washer on the grounding bolt.



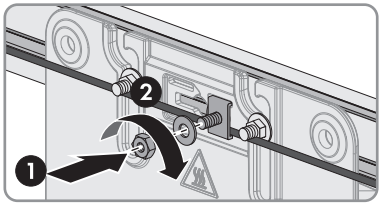
3. Align the equipment grounding conductor horizontally underneath or on top of the grounding bolt.



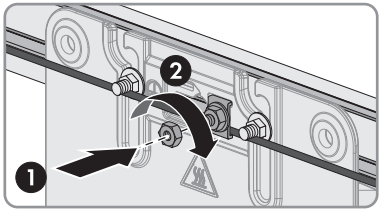
4. Position the clamping bracket on the grounding bolt over the equipment grounding conductor. Depending on the conductor cross-section, the clamping bracket **will not necessarily** lock into place in the horizontal slots.



5. Place the second washer and one hexagon nut on the grounding bolt and tighten (torque: 3.5 Nm (31 in-lb)).



6. Place the second hexagon nut on the grounding bolt and tighten (torque: 3.5 Nm (31 in-lb)).

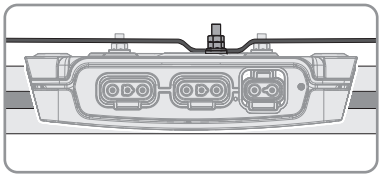


7. *NOTICE*

Prevention of contact corrosion by bending the equipment grounding conductor

The equipment grounding conductor should not be in contact with the inverter enclosure. Contact may result in corrosion at the contact surface. Contact between fastening screws and nuts is permitted.

- Bend the equipment grounding conductor to ensure that there is no contact with the inverter enclosure.



8. Connect the equipment grounding conductor to the equipotential bonding of the AC distribution board.

5.4 Requirements for Mounting the Sunny Multigate

Requirements for the mounting location:

⚠ WARNING

Danger to life due to fire or explosion

Despite careful construction, electrical devices can cause fire.

- Do not mount the product in areas containing highly flammable materials or gases.
- Do not mount the product in potentially explosive atmospheres.

⚠ WARNING

Danger of fire due to non-UL50E industrial enclosure

The Sunny Multigate is only protected against fire if it is installed in an industrial enclosure complying with UL50E. Otherwise, the fire risk could lead to personal injury and property damage.

- For indoor use, always install the Sunny Multigate in a Type 1 industrial enclosure with pollution degree 3.
- For outdoor use, always install the Sunny Multigate in a Type 3 industrial enclosure with pollution degree 3.

NOTICE

Damage to the Sunny Multigate from moisture and dust intrusion

Dust or moisture intrusion can damage the Sunny Multigate and impair its functionality. The Sunny Multigate must always be installed in an industrial enclosure with back panel complying with UL50E. This will ensure that the Sunny Multigate is protected against dust and moisture and is suitable for indoor and outdoor operation.

- For indoor use, always install the Sunny Multigate in a Type 1 industrial enclosure with pollution degree 3.
- For outdoor use, always install the Sunny Multigate in a Type 3 industrial enclosure with pollution degree 3.

☐ The mounting location must be inaccessible to children.

☐ The mounting location must be suitable for the installation of the Sunny Multigate in an industrial enclosure of Type 1 or Type 3.

☐ AC cable route of the entire PV system with Sunny Multigate: maximum 30 m (100 ft.). When installing several Sunny Multigate devices in a PV system, it may be necessary to lay the AC cable of each Sunny Multigate to the respective inverter separately in order to guarantee trouble-free communication between the Sunny Multigate and the inverter.

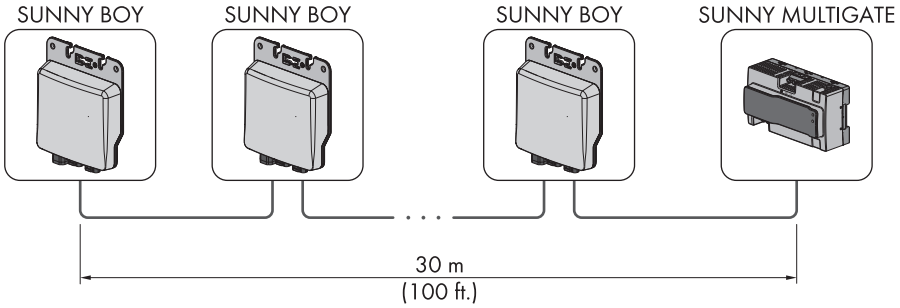


Figure 11: Maximum AC cable route of the PV system (left: last inverter; right: first inverter connected to Sunny Multigate).

- ☐ A robust support surface must be available for mounting the device, e.g. concrete, walls. In living areas, ensure that the support surface is not plasterboard or similar.
- ☐ The mounting location must be suitable for the weight and dimensions of the industrial enclosure with the Sunny Multigate (see Section 13 "Technical Data", page 71).
- ☐ The mounting location should be clear and safely accessible at all times without the need for any auxiliary equipment (such as scaffolding or lifting platforms). Non-fulfillment of these criteria may restrict servicing.
- ☐ The mounting location should not be exposed to direct solar irradiation.
- ☐ Climatic conditions must be met (see Section 13 "Technical Data", page 71).
- ☐ The ambient temperature must be between −40 °C and +45 °C (−40 °F to +113 °F). This will ensure optimal operation of the Sunny Multigate.

Dimensions for mounting with screws:

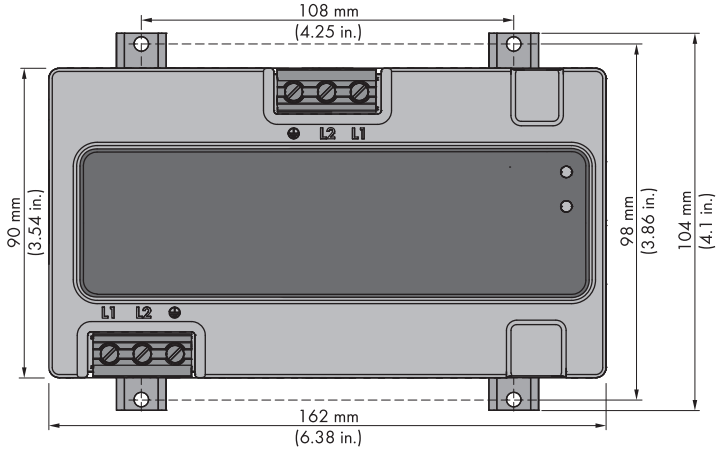


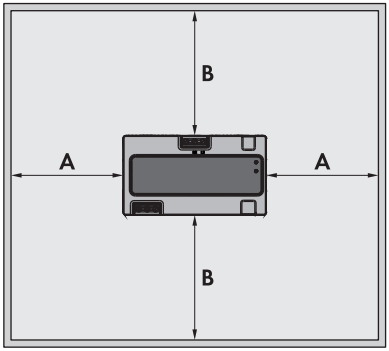
Figure 12: Dimensions of the drill holes for mounting with screws

Minimum clearances of the Sunny Multigate inside the metal industrial enclosure:

- ☐ The minimum clearance of the Sunny Multigate to the outer walls of the metal industrial enclosure is 12.7 mm (0.5 in.).

Recommended clearances:

- ☐ Observe the recommended clearances within the industrial enclosure.



A = 98 mm (3.86 in.) B = 150 mm (5.9 in.)

Figure 13: Recommended clearances

Permitted mounting positions:

☐ Only mount the Sunny Multigate horizontally in the industrial enclosure.

5.5 Mounting the Sunny Multigate in an Industrial Enclosure

Mounting Options

- Mounting on top-hat rail in industrial enclosure with back panel complying with UL50E
- Mounting with bolts in industrial enclosure with back panel complying with UL50E

Additionally required mounting material (not included in the scope of delivery):

☐ For indoor use: industrial enclosure complying with UL50E Type 1

☐ For outdoor use: industrial enclosure complying with UL50E Type 3

☐ Back panel that is suitable for the industrial enclosure complying with UL50E

☐ For mounting on top-hat rail: top-hat rail (DIN rail) suitable for the industrial enclosure Width: 35 mm (1.4 in.), length: 235 mm (9.3 in.)

☐ When mounting with press-out brackets: four screws suitable for the size of the brackets and for the material of the back panel mounted in the industrial enclosure. The maximum permissible height of the screw head of 6 mm (0.2 in.) must not be exceeded.

Requirements for the industrial enclosure:

☐ Industrial enclosure with back panel complying with UL50E, Type 3 for outdoor use and Type 1 for indoor use

☐ Pollution degree 3

☐ Material: plastic or metal

☐ Minimum dimensions (W x H x D): 260 mm x 240 mm x 120 mm (10.3 in. x 9.5 in. x 4.7 in.)

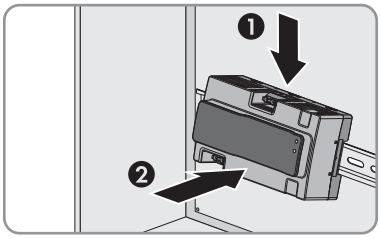
☐ Minimum volume: 19 liters

- ☐ Fire protection class: minimum UL 94 5VA
- ☐ Operating temperature range: −40 °C to +45 °C (−40 °F to 113 °F)
- ☐ A warning label with the following text must be available:
  "DANGER - Risk of Electric Shock. Do not remove cover. No user serviceable parts inside. Refer servicing to qualified service personnel."
  "DANGER - Hazardous voltage remains for five minutes after disconnecting main power supply."

  Useful hint: You can use the warning labels included in the scope of delivery. The warning label included in the scope of delivery is made of Scotchcal Brand 3690 from 3M and only suitable for certain surfaces according to UL-listing (see E-File no. MH18072, category PGJI2). Example: Alkyd paint, aluminum, Polyester paint, zinc.

Mounting on top-hat rail

1. For mounting on a top-hat rail, attach the Sunny Multigate to the top-hat rail from above, and hook it in.



   ☑ The Sunny Multigate snaps audibly into place.
2. Make sure that the Sunny Multigate is securely in place.
3. Attach the supplied warning label in a clearly legible position on the outside of the industrial enclosure lid.

Mounting with Screws

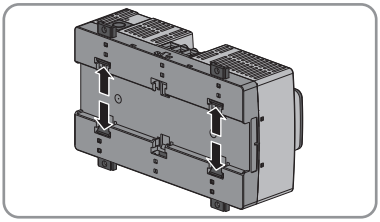
For mounting with screws, use the four brackets on the rear panel of the Sunny Multigate.

1. **⚠ WARNING**

   Danger to life due to electric shock

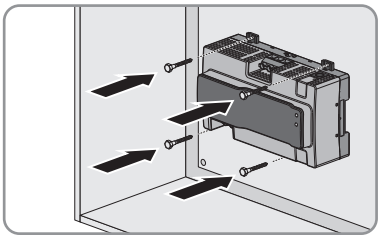
   If screws or conductors on the connecting terminal plate are touched, there is a risk of electric shock.

   - To avoid contact between screws and conductors, only use screws with a maximum head height of 6 mm (0.2 in.) for mounting on the brackets.
2. Press the brackets out from the inside.



☑ The brackets snap audibly into place.

3. Mark the drill holes on the back panel using the brackets as a template.
4. Drill the holes in the back panel.
5. Insert screws with a maximum head height of 6 mm (0.2 in.) through the brackets and tighten. Make sure not to damage the brackets.



6. Make sure that the Sunny Multigate is securely in place.
7. Attach the supplied warning label in a clearly legible position on the outside of the industrial enclosure lid.

5.6 Grounding the Metal Industrial Enclosure

If you use an industrial enclosure made of metal, you must ground the industrial enclosure in accordance with the *National Electrical Code®* and the following procedure.

Additionally required material (not included in the scope of delivery):

☐ Connecting terminal plate for grounding the industrial enclosure, its door and the Sunny Multigate

☐ Cable type: copper with conductor cross-section of at least 2.5 mm² (14 AWG)

☐ Cable type: aluminum made of copper-coated wire with conductor cross-section of at least 4 mm² (12 AWG)

- Connect the grounding of the industrial enclosure to the grounding of the Sunny Multigate and the door of the industrial enclosure. Use the connecting terminal plate for grounding.

6 Electrical Connection

6.1 Safety during Electrical Connection

⚠ DANGER

Danger to life due to electric shock

Do not disconnect under load

PV plug connections must not be disconnected while under load. They can be placed in a no load state by switching off the DC/AC converter or breaking the AC circuit.

- Make sure that the two-pole circuit breaker is switched off and cannot be reconnected.
- Make sure that the PV modules are covered.

⚠ DANGER

Risk of electric shock due to contact with live components when opening the Sunny Multigate

There are live components inside the Sunny Multigate. There is a risk of electric shock if you open the Sunny Multigate.

- **Never** open the Sunny Multigate.

NOTICE

Damage to the inverter due to moisture ingress

When the inverter is open, moisture can penetrate and cause damage to the inverter. The tightness is no longer intact and the function of the inverter cannot be guaranteed.

- **Never** open the inverter.

⚠ CAUTION

Risk of fire

- To reduce the risk of fire, connect only to a circuit provided with 15 A maximum branch-circuit overcurrent protection in accordance with the *National Electrical Code*® (NE, ANSI/NFPA 70).

Electrical installations

All electrical installations must be carried out in accordance with the local standards and the *National Electrical Code*® ANSI/NFPA 70 or the *Canadian Electrical Code*® CSA C22.1.

- With an ungrounded PV array/PV module the *National Electrical Code*®, ANSI/NFPA 70 wiring methods are to be used, including Sec. 690.35.
- The DC input and AC output circuits are isolated from the enclosure and that system grounding, if required by Section 250 of the *National Electrical Code*®, ANSI/NFPA 70, is the responsibility of the installer.
- The provisions in the *National Electrical Code*® article 690.8 (A)(3) for determination of the maximum micro inverter output circuit current apply to this product.
- The circuit conductors and overcurrent devices are considered to be subjected to the maximum micro inverter output circuit current and shall be sized to carry not less than 125% of the maximum currents as required by the *National Electrical Code*® article 690.8(A)(3).
- The overcurrent protection for the AC output circuit is to be provided by the installer.
- If cables of type TC-ER (Tray Cable Exposed Run) are used, the requirements of the *National Electrical Code*®, article 336.10 must be observed.
- Make sure that no cables used for electrical connection are damaged.

6.2 Connection Areas

6.2.1 Sunny Boy

View from Below

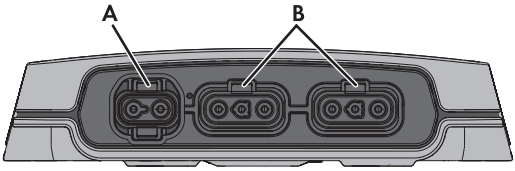


Figure 14: Connection areas at the bottom of the inverter

Item	Designation	Explanation
A	DC pin connector	Terminal for the DC plug
B	AC pin connector	• For connection of the AC cable for linking two inverters (daisy chain) • For connection of the AC cable for linking the first inverter to the Sunny Multigate • For inserting the protective cap

6.2.2 Sunny Multigate

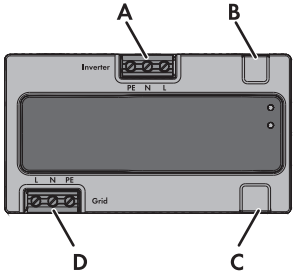


Figure 15: Connection areas on the Sunny Multigate

Item	Designation
A	Connecting terminal plate for the connection of the AC cable of the inverter, labeling: **Inverter**
B	Pin connector for connecting the optional communication
C	Pin connector for connecting the network cable (RJ45)
D	Connecting terminal plate for the connection of the AC cable of the utility grid, labeling: **Grid**

6.3 Connecting the AC Cable to the Inverters

Overview

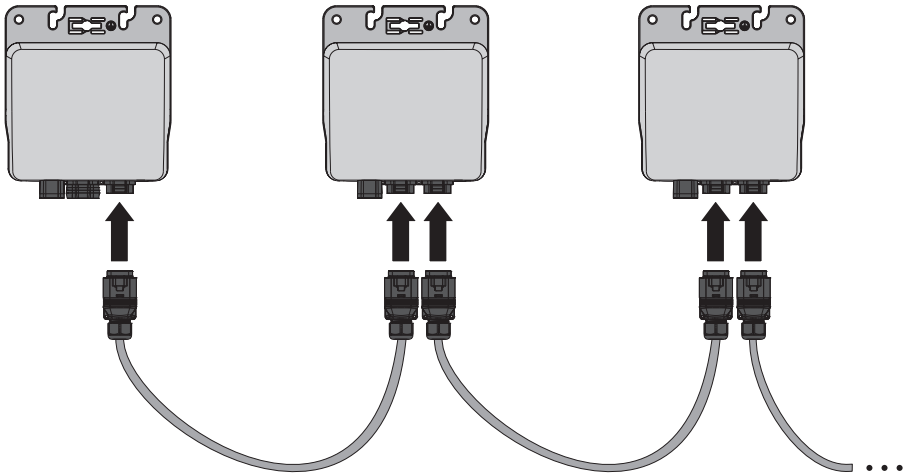


Figure 16: AC cabling between the inverters (left: last inverter; right: first inverter)

Requirements:

- ☐ All electrical installations must be carried out in accordance with all electrical standards applicable on-site and the *National Electrical Code®* (NE, ANSI/NFPA 70) (see *National Electrical Code®*, paragraph 690.8 (B)(1), paragraph 690.8(A)(3)) or the *Canadian Electrical Code®* CSA C22.1.
- ☐ The maximum output current of the inverter must comply with the *National Electrical Code®*, paragraph 690.8 (A)(3).
- ☐ For fusing purposes, use at maximum a two-pole, 15 A circuit breaker.
- ☐ No loads must be connected between the individual inverters.
- ☐ Overcurrent protection must comply with the *National Electrical Code®*, paragraph 690.9.
- ☐ For the AC cable connection to the Sunny Boy, only use the AC cable recommended by SMA (see Section 14 "Accessories", page 76).
- ☐ Only use cables of type TC-ER observing the requirements of the *National Electrical Code®*, article 336.10.

Procedure:

1. **⚠ DANGER**

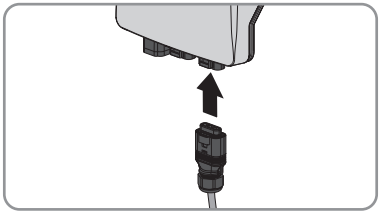
   Danger to life due to electric shock

   Do not disconnect under load

   PV plug connections must not be disconnected while under load. They can be placed in a no load state by switching off the DC/AC converter or breaking the AC circuit.

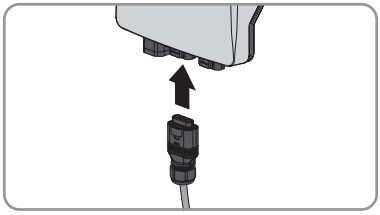
   - Make sure that the two-pole circuit breaker is switched off and cannot be reconnected.
   - Make sure that the PV modules are covered.

2. Plug one end of the supplied AC cable into the outer AC pin connector of the last inverter.



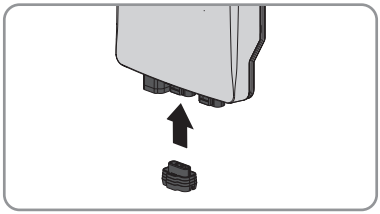
   ☑ The plug clicks audibly into place.

3. Plug the other end of the AC cable into the middle AC pin connector of the next inverter.



   ☑ The plug clicks audibly into place.

4. Insert the protective cap into the free AC pin connector of the last inverter.



☑ The protective cap snaps audibly into place.

5. Make sure that the AC connector and the protective cap are securely in place in the inverter pin connectors.
6. Connect the free end of the AC cable of the first inverter to the AC field plug or to the terminal of the junction box:
   - Option 1: via AC field plug (see Section 6.6 "Option 1: AC Cabling with AC Field Plug", page 41).
   - Option 2: via junction box with feed-through terminal Option 2: AC Cabling with Junction Box.
7. To allow for greater distances between two inverters, use the AC field plug (see Section 6.6, page 41).
8. Connecting the PV Module to the Inverter (see Section 6.4, page 39)

6.4 Connecting the PV Module to the Inverter

Only connect one PV module to each inverter in accordance with the following procedure.

Requirements:

☐ All electrical installations must be carried out in accordance with all electrical standards applicable on-site and the *National Electrical Code®* (NE, ANSI/NFPA 70) (see *National Electrical Code®*, paragraph 690.8 (B)(1), paragraph 690.8(A)(3)) or the *Canadian Electrical Code®* CSA C22.1.

☐ The PV modules must be correctly mounted in accordance with the manufacturer specifications.

☐ Each inverter must be connected to no more than one PV module.

☐ The thresholds for the input voltage and the input current of the inverter must be adhered to.

☐ The positive connection cable (DC+) of the PV module must be fitted with a positive DC connector suitable for the DC connector of the inverter.

☐ The negative connection cable (DC−) of the PV module must be fitted with a negative DC connector suitable for the DC connector of the inverter.

Procedure:

1. **⚠ DANGER**

   Danger to life due to electric shock

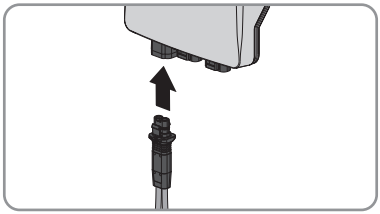
   Do not disconnect under load

   PV plug connections must not be disconnected while under load. They can be placed in a no load state by switching off the DC/AC converter or breaking the AC circuit.

   - Make sure that the two-pole circuit breaker is switched off and cannot be reconnected.
   - Make sure that the PV modules are covered.

2. Check the PV module for ground faults (see Section 11.3, page 67).
3. Check the DC connectors of the PV module for correct polarity and connect to the DC connectors of the supplied DC plug. Tip: for correct assignment, the DC plug is marked with + and –.

   ☑ The DC connectors snap into place.
4. Make sure that the DC connectors are securely in place.
5. Insert the DC plug with the DC connectors into the outer pin connector on the inverter.



6. Connect the first inverter of the PV system to the Sunny Multigate (see Section 6.8, page 46).

6.5 AC Cabling from Inverter to Sunny Multigate

You have the option of implementing the AC cabling from the inverter to the Sunny Multigate using either the supplied AC field plug or a junction box with integrated feed-through terminal.

Option 1

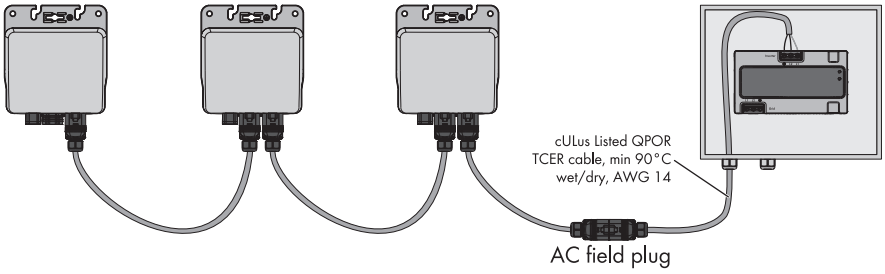


Figure 17: AC cabling of the entire PV system with AC field plug

Option 2

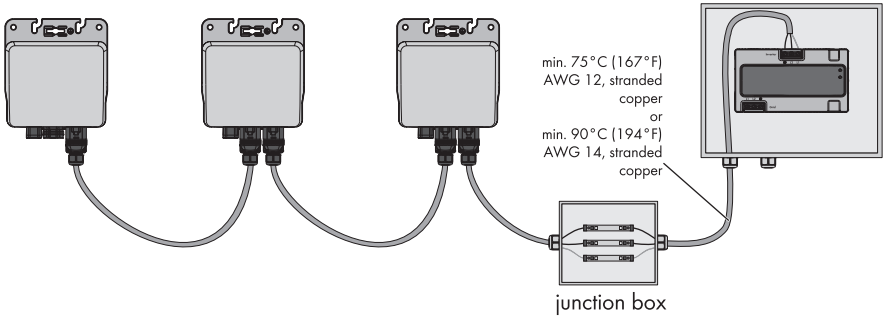


Figure 18: AC cabling of the entire PV system with junction box (example)

Conduit required

For cable types used in Option 2, the use of a conduit is required.

6.6 Option 1: AC Cabling with AC Field Plug

6.6.1 Assembling the AC Field Plug

The AC cable with the two connectors is used to interconnect the inverters over a distance of max. 1.70 meters (5.6 ft.). To allow for greater distances between two inverters or to connect the inverter with the Sunny Multigate, you will need the enclosed AC field plug.

Overview

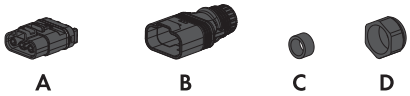


Figure 19: Elements of the AC field plug

Position	Designation
A	Insulator
B	Enclosure
C	Seal
D	Screw connection

Additionally required material (not included in the scope of delivery) (see Section 14 "Accessories", page 76):

- ☐ 3 bootlace ferrules 2.5 mm² (14 AWG)
- ☐ Cable complying with UL6703 (PV wire)
- ☐ Cable shears with insulated handles, 165 mm (6.5 in.)
- ☐ Stripping knife with straight blade, TiN 8 mm to 28 mm (0.3 in. to 1.1 in.)

- ☐ Insulation stripping tool, 10 mm² (7 AWG)
- ☐ Crimping tool for bootlace ferrules up to 10 mm² (7 AWG)
- ☐ Torque screwdriver, 1.4" hexagon socket, 0.3 Nm to 1.2 Nm (2.7 in-lb to 10.6 in-lb)
- ☐ Bit 1.4" hexagon, 25 mm (1 in.), for cross-head screws
- ☐ Torque wrench, scale adjustable from 2 Nm to 20 Nm (17.7 in-lb to 177 in-lb)
- ☐ Crow-Ring wrench, AF 25
- ☐ Square insertion tool, outer square: 10 mm (0.38 in.), inner square: 9 x 12 mm (0.36 x 0.47 in.)
- ☐ Screwdriver, insulated with blade width 4 mm (0.16 in.) and blade thickness 0.8 mm (0.03 in.)

Cable requirements:

- ☐ Cable cross-section: 2.5 mm² (14 AWG)
- ☐ External diameter of the cable sheath: 8.8 mm to 9.6 mm (0.35 in. to 0 38 in.)
- ☐ Wire cross-section: 30 AWG
- ☐ Number of stranded wires: 46
- ☐ Cable type: copper wire
- ☐ Kabeltyp: UL listed (QPOR) Power and Control Tray cable, type TC-ER (LAPP-Tray Cable II A 3 G AWG 14/46 BK). With this cable type, the use of a conduit is not required.
- ☐ Temperature: at least +90 °C (+194 °F) wet/dry

Assemble the AC field plug as follows:

⚠ DANGER

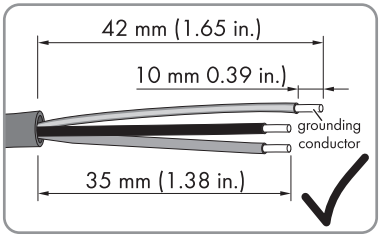
Danger to life due to electric shock

- Do not disconnect or connect the AC field plug under load.
- Only assemble the AC field plug in a dry environment.
- Observe the operating temperature range of −40 °C to +85 °C (−40 °F to +185 °F).
- Note and adhere to the requirements of the *National Electrical Code®*, ANSI/NFPA 70).

Assembling the Cable

1. Shorten the cable to the desired length using cable shears.
2. Dismantle the shortened cable by 42 mm (1.65 in.) using the stripping knife. Take care not to damage the individual insulated conductors.
   - The grounding conductor must be 42 mm (1.65 in.) long. The grounding conductor must be approximately 7 mm (0.28 in.) longer than L1 and L2.
   - L1 and L2 must each be 35 mm (1.38 in.) long.
3. Using the insulation stripping tool, strip the insulation of the three individual conductors by 10 mm (0.39 in.) each (tolerance: ± 1 mm / ± 0.04 in.). Take care not to damage the individual stranded wires.

☑ The cable is assembled.



☑ The cable is assembled.

4. Push one bootlace ferrule onto each stripped insulated conductor up to the stop. Do not touch the stranded wires with your fingers and do not change the twist direction of the stranded wires.
5. Crimp the bootlace ferrule tightly using a crimping tool.
6. Ensure that a crimping length of max. 2.4 mm (0.09 in.) is maintained.

Premounting the AC Field Plug

1. Slide the nut over the cable with the bootlace ferrules. Make sure that the thread of the nut is facing the bootlace ferrule.
2. Push the seal with your fingers as far as possible into the AC plug enclosure.
3. Lead the cable through the AC plug enclosure with the seal. The thread must be facing the thread of the nut.

Mounting the Insulator

1. Push the stranded wires with the bootlace ferrules up to the stop in the premounted pin connectors inside the insulator. L1 must be plugged into pin connector **L1**, L2 into pin connector **L2** and the grounding conductor into the pin connector with the symbol ⏚ .
   ☑ The bootlace ferrules are no longer visible.
2. Tighten the three screws in the insulator using a screwdriver (torque: 0.8 Nm (7 in-lb)).
3. Make sure that the individual conductors are positioned securely in the correct pin connectors of the insulator.

Completing Mounting of the AC Field Plug

1. Push the AC plug enclosure onto the insulator.
   ☑ Both parts snap audibly together. The catch mechanism on the insulator and on the AC plug enclosure must be correctly aligned.
2. Screw the nut of the AC plug enclosure on and use a torque wrench to tighten the nut twice in a row with two different torques.
   - First tighten the nut with a torque of 3.3 Nm (29.2 in-lb.). Set the value 3.0 Nm (26.6 in-lb) on the scale of the torque wrench specified by SMA.
   - Then tighten the nut with a torque of 5.1 Nm (45.1 in-lb). Set the value 4.6 Nm (40.7 in-lb) on the scale of the torque wrench specified by SMA.

Useful hint: The given torque setting only applies to the torque wrench specified by SMA. The value to be set on the torque wrench is lower than the actual value (for more information on the calculation of the torque to be set, go to www.stahlwille.com). A torque wrench consists of the following components: torque wrench (basic device), square insertion tool and crow's foot wrench.

3. Make sure that the nut of the AC plug enclosure is securely fastened.

6.6.2 Connecting the AC Field Plug to the AC Cable of the Inverter

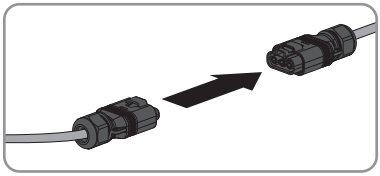
1. **⚠ DANGER**

   Danger to life due to electric shock

   Do not connect the AC field plug under load.

   - Make sure that the two-pole circuit breaker of the Sunny Multigate is switched off and cannot be reconnected.
   - Make sure that the PV modules are covered.

2. Plug the free end of the AC cable connected to the inverter into the pin connector of the assembled AC field plug.



☑ The AC field plug snaps audibly into place. The catch mechanisms of both plugs must be correctly aligned.

6.6.3 Disconnecting the AC Field Plug from the Inverter AC Cable

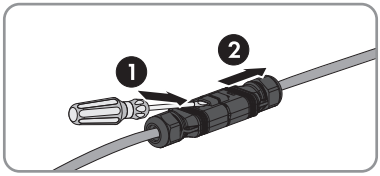
1. **⚠ DANGER**

   Danger to life due to electric shock

   Do not disconnect the AC field plug under load.

   - Make sure that the two-pole circuit breaker of the Sunny Multigate is switched off and cannot be reconnected.
   - Make sure that the PV modules are covered.

2. Unlock and remove the AC field plug from the connector of the inverter AC cable. Hook a flat-blade screwdriver (blade width: 4 mm (0.16 in.)) into the wide slot on the AC field plug and lever it open. At the same time, pull out the AC connector.



6.6.4 Removing and Reassembling the AC Field Plug

Removing and reassembling the AC field plug is only possible within 72 hours

- In total, the AC field plug may at maximum be removed three times and only within the first 72 hours after the first assembly.
- After the period of 72 hours has expired, the AC field plug must not be removed.
- The cable must be shortened again before each assembly.

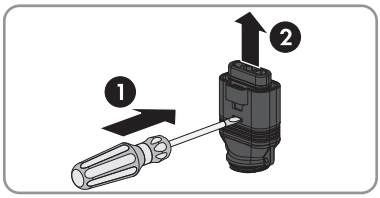
Procedure:

1. **⚠ DANGER**

   Danger to life due to electric shock

   Do not disconnect the AC field plug under load.

   - Make sure that the two-pole circuit breaker of the Sunny Multigate is switched off and cannot be reconnected.
   - Make sure that the PV modules are covered.
2. Disconnect the AC field plug from the AC cable of the inverter (see Section 6.6.3, page 44).
3. Loosen the nut of the AC plug enclosure.
4. Remove the seal from the opening of the thread. Make sure not to damage the fins of the AC plug enclosure.
5. Detach the AC plug enclosure from the insulator. Insert a flat-blade screwdriver (blade width: 4 mm (0.16 in.)) into the small slot on the AC plug enclosure and release the fastening clamps until the insulator detaches from the AC plug enclosure.



6. Loosen all three screws using a screwdriver and remove the conductors.
7. Shorten the cable and reassemble the AC field plug (see Section 6.6.1, page 41).

6.7 Option 2: AC Cabling with Junction Box

As an alternative to the AC field plug, you can use a junction box with feed-through terminal for the connection of the inverter AC cable to the Sunny Multigate. For the assembly and connection of the AC cable, follow the instructions of the junction box manufacturer. All electrical installations must be carried out in accordance with the locally applicable electrical standards and the *National Electrical Code®* (NE, ANSI/NFPA 70) (see *National Electrical Code®*, paragraph 690.8 (B)(1), paragraph 690.8(A)(3)).

- This cable must be installed in an inaccessible location or in a *National Electrical Code®* compliant conduit.

6.8 Connecting the Inverter to the Sunny Multigate

Connect the free end of the AC cable coming from the AC field plug or the junction box to the connecting terminal plate of the Sunny Multigate. The connecting terminal plate assigned for this is labeled **Inverter**.

Requirements:

- ☐ All electrical installations must be carried out in accordance with all electrical standards applicable on-site and the *National Electrical Code®* (NE, ANSI/NFPA 70) (see *National Electrical Code®*, paragraph 690.8 (B)(1), paragraph 690.8(A)(3)) or the *Canadian Electrical Code®* CSA C22.1.
- ☐ The Sunny Multigate is correctly installed in the industrial enclosure.

Cable requirements:

- ☐ Do not use shielded cables.
- ☐ Only use copper cables.
- ☐ Temperature-resistant up to at least +90 °C (+194 °F) wet/dry
- ☐ Use only cables with stranded wires.
- ☐ Conductor cross-section: 1.5 mm² to 6 mm² (16 AWG to 10 AWG)
- ☐ Do not use *Wire Nuts®*.

i Installation of several Sunny Multigate devices

When installing several Sunny Multigate devices in a PV system, a three-wire cable with grounding conductor must be used for each Sunny Multigate in order to guarantee trouble-free communication between the Sunny Multigate and the inverter.

Procedure:

1. **⚠ DANGER**

   Danger to life due to electric shock

   Do not disconnect under load

   PV plug connections must not be disconnected while under load. They can be placed in a no load state by switching off the DC/AC converter or breaking the AC circuit.

   - Make sure that the two-pole circuit breaker is switched off and cannot be reconnected.
   - Make sure that the PV modules are covered.
2. Route the AC cable of the inverter through one opening at the bottom of the industrial enclosure to the terminal **Inverter** of the Sunny Multigate.
3. Dismantle the AC cable to the desired length.
4. Strip the insulation of the three AC cable conductors by 8 mm (0.31 in.) each.

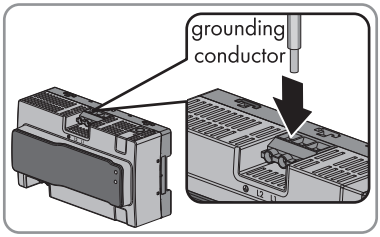
5. *NOTICE*

Damage to the Sunny Multigate due to incorrectly connected conductors

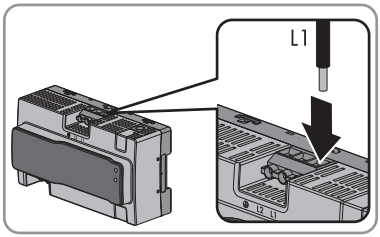
If the grounding conductor and L1 or L2 are swapped, the Sunny Multigate could be damaged during commissioning.

- Be sure to observe the terminal labels on the Sunny Multigate.
- Connect all conductors in accordance with the terminal labels.

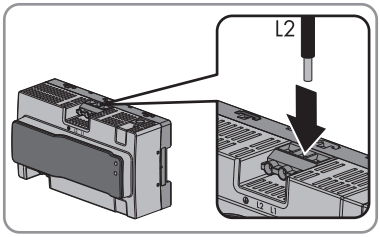
6. Connect the grounding conductor of the AC cable to the terminal ⏚ of the Sunny Multigate. Make sure that the conductor is inserted into the terminal right up to the stop.



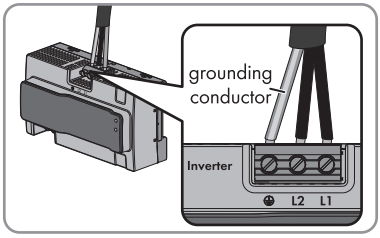
7. Connect the conductor L1 of the AC cable to the terminal **L1** of the Sunny Multigate. Make sure that the conductor is inserted into the terminal right up to the stop.



8. Connect the conductor L2 of the AC cable to the terminal **L2** of the Sunny Multigate. Make sure that the conductor is inserted into the terminal right up to the stop.



9. Tighten all three screws of the connecting terminal plate using a flat-blade screwdriver (blade width: 3.5 mm (0.14 in.)) (torque: 0.6 Nm (5.31 in-lb)).
10. Make sure that all terminals are correctly allocated.



11. Make sure that all conductors are securely in place.

6.9 Connecting the Sunny Multigate to the Utility Grid

Connect the AC cable of the utility grid to the connecting terminal plate of the Sunny Multigate labeled **Grid** according to the following procedure:

Cable requirements:

- ☐ Only use copper cables.
- ☐ Use only cables made of solid wire or stranded wires.
- ☐ Temperature: +90 °C (+194 °F) wet/dry
- ☐ Conductor cross-section: 1.5 mm² to 6 mm² (16 AWG to 10 AWG)
- ☐ Do not use *Wire Nuts*®.

Requirements:

- ☐ All electrical installations must be carried out in accordance with all electrical standards applicable on-site and the *National Electrical Code*® (NE, ANSI/NFPA 70) (see *National Electrical Code*®, paragraph 690.8 (B)(1), paragraph 690.8(A)(3)) or the *Canadian Electrical Code*® CSA C22.1.
- ☐ The DC input and AC output circuits are isolated from the enclosure and that system grounding, if required by Section 250 of the *National Electrical Code*®, ANSI/NFPA 70, is the responsibility of the installer.
- ☐ The maximum output current of the inverter must comply with the *National Electrical Code*®, paragraph 690.8 (A)(3).
- ☐ Overcurrent protection must comply with the *National Electrical Code*®, paragraph 690.9.
- ☐ The Sunny Multigate must be correctly installed in the industrial enclosure.

Procedure:

1. **⚠ DANGER**

   Danger to life due to electric shock

   - Make sure that the two-pole circuit breaker of the Sunny Multigate is switched off and cannot be reconnected.

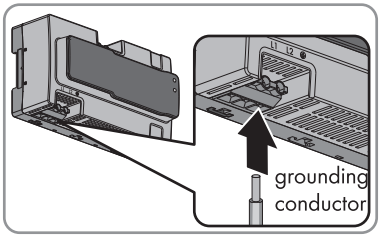
2. Route the AC cable of the utility grid through one opening at the bottom of the industrial enclosure to the terminal **Grid** of the Sunny Multigate.
3. Strip 8 mm (0.31 in.) insulation off each of the three conductors of the AC cable of the utility grid.
4. ***NOTICE***

   Damage to the Sunny Multigate due to incorrectly connected conductors

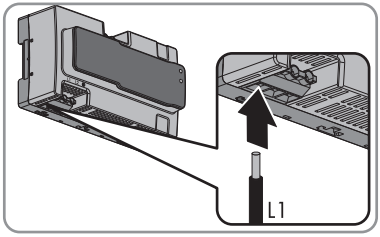
   If the grounding conductor and L1 or L2 are swapped, the Sunny Multigate could be damaged during commissioning.

   - Be sure to observe the terminal labels on the Sunny Multigate.
   - Connect all conductors in accordance with the terminal labels.

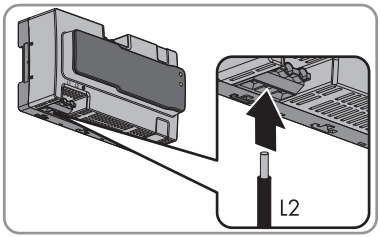
5. Connect the grounding conductor of the AC cable to the terminal ⏚ of the Sunny Multigate. Make sure that the conductor is inserted into the terminal right up to the stop.



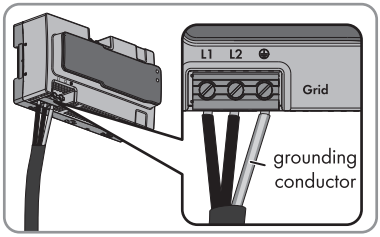
6. Connect the conductor L1 of the AC cable to the terminal **L1** of the Sunny Multigate. Make sure that the conductor is inserted into the terminal right up to the stop.



7. Connect the conductor L2 of the AC cable to the terminal **L2** of the Sunny Multigate. Make sure that the conductor is inserted into the terminal right up to the stop.



8. Tighten all three screws of the connecting terminal plate using a flat-blade screwdriver (blade width: 3.5 mm (0.14 in.)) (torque: 0.6 Nm (5.31 in-lb)).
9. Make sure that all terminals are correctly allocated.



10. Make sure that all conductors are securely in place.
11. Connect the grounding conductor of the utility grid to the grounding conductor terminal on the Sunny Multigate.

7 Commissioning

Requirements:

- ☐ All inverters must be correctly mounted.
- ☐ The AC connectors must be firmly plugged in.
- ☐ The DC plug and the connectors must be firmly plugged in.
- ☐ The connection areas of all inverters must be dry and sealed rain-tight by means of connectors and, where applicable, a protective cap.
- ☐ The PV modules must be correctly mounted.
- ☐ The circuit breaker must be correctly rated.
- ☐ The Sunny Multigate must be correctly installed in the industrial enclosure.
- ☐ The unused AC pin connector on the last inverter of the PV system must be sealed with a protective cap.
- ☐ The first inverter of the PV system must be correctly connected to the Sunny Multigate via the AC cable. All conductors must be connected in accordance with the terminal labels. No conductors must be swapped.
- ☐ The AC cable of the utility grid must be correctly connected to the Sunny Multigate. All conductors must be connected in accordance with the terminal labels. No conductors must be swapped.

NOTICE

Damage to the Sunny Multigate due to incorrectly connected conductors

If the grounding conductor and L1 or L2 are swapped, the Sunny Multigate could be damaged during commissioning.

- Be sure to observe the terminal labels on the Sunny Multigate.
- All conductors must be connected in accordance with the terminal labels.
- Make sure that all terminals are correctly allocated.

Procedure:

- Switch on the two-pole circuit breaker.

☑ Both LEDs on the Sunny Multigate are glowing green. Feed-in operation begins.

✖ The LED **Inverter** is off?

There is a disturbance in the PV system.

- You will find the detailed error message in Sunny Portal or Sunny Explorer. You can find the cause and its corrective measure in this document (see Section 11.2 "Events: Information, Warnings and Errors", page 61).

✖ The LED **Inverter** on the Sunny Multigate is glowing orange or red?

There is a disturbance in at least one of the connected inverters.

- You will find the detailed error message in Sunny Portal or Sunny Explorer. You can find the cause and its corrective measure in this document (see Section 11.2 "Events: Information, Warnings and Errors", page 61).

✖ The LED **Multigate** on the Sunny Multigate is glowing orange or red?
There is a disturbance in the Sunny Multigate.

- Identify and eliminate the disturbance (see Section 11.1 "LED Signals on the Sunny Multigate", page 60).

8 Configuration

8.1 Connecting the Sunny Multigate to the Network

You can configure the Sunny Multigate and the inverters using an SMA communication product (e.g. Sunny Portal, Sunny Explorer).

In order to register your PV system in Sunny Portal, you must connect the Sunny Multigate to the local network.

Required material (not included in the scope of delivery):

☐ One network cable

Cable requirements:

☐ Type of cable: 100BaseTx, CAT5 with S-FTP or S-STP shielding
SMA recommends cable type "SMA COMCAB-OUTxxx" for outdoor use and cable type "SMA COMCAB-INxxx" for indoor use, available in lengths xxx = 100 m (328 ft.), 200 m (656 ft.), 500 m (1,640 ft.), 1,000 m (3,280 ft.)

☐ Cross-section: at least 2 x 2 x 0.22 mm² or at least 2 x 2 x 24 AWG

☐ Maximum cable length: 100 m (328 ft.)

☐ UV-resistant for outdoor use

☐ Type of plug: RJ45

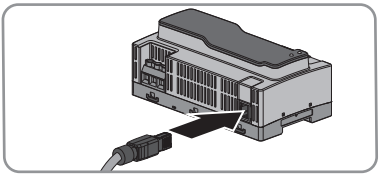
Requirements:

☐ The PV system must be commissioned (see Section 7 "Commissioning", page 50).

☐ A computer with an Ethernet interface must be available.

Procedure:

1. Connect one end of the network cable to the router or directly to the computer.
2. Plug the other end of the network cable into the pin connector at the bottom of the Sunny Multigate.



☑ The green LED in the pin connector is glowing or flashing. The Sunny Multigate is connected to the router or the computer.

☑ The green LED in the pin connector is glowing or flashing and the yellow LED is glowing: A 100 Mbit connection to the router or the computer is established.

✖ All LEDs in the pin connector are off.

Possible failure cause: the other end of the network cable is not correctly attached or there is no voltage supply.

- Make sure that the router or computer is supplied with voltage.
- Make sure that the network cable is correctly attached.

- If the network cable is correctly attached and the problem persists, contact the SMA Service Line (see Section 16 "Contact", page 79).

8.2 Registering the Sunny Multigate in Sunny Portal

If you want to use the Webconnect function and monitor your PV system in Sunny Portal, you must register the Sunny Multigate in Sunny Portal.

Requirements:

- ☐ The PV system must be commissioned (see Section 7 "Commissioning", page 50).
- ☐ The Sunny Multigate must be connected to a router or modem with Internet access and must be integrated in the local network. If the router or the modem does not support DHCP, or if DHCP is deactivated, you can use the SMA Connection Assist to integrate the Sunny Multigate into your network (see www.SMA-Solar.com).
- ☐ All UDP ports > 1024 on the router or modem must be open for outgoing connections. If there is a firewall installed on the router or modem, you might have to adjust the firewall rules.
- ☐ It must be possible for the outgoing router or modem connections to reach all Internet destinations (target IP, target port). If there is a firewall installed on the router or modem, you might have to adjust the firewall rules.
- ☐ On a router or modem with NAT (Network Address Translation) there must not be any port forwarding. Potential communication problems can thus be prevented.
- ☐ There must be no packet filtering and no manipulation for SIP packets on the router or modem.
- ☐ The registration ID (RID) and identification key (PIC) for registration in Sunny Portal must be available (see type label on the Sunny Multigate or enclosed label).

Procedure:

- Register the Sunny Multigate in Sunny Portal (see User Manual "Micro Inverters in Sunny Portal" at www.SunnyPortal.com).
  Useful hint: The PV System Setup Assistant guides you through user registration and the registration of your PV system in Sunny Portal.

8.3 Connecting the Sunny Multigate to Sunny Explorer

Requirements:

- ☐ The PV system must be commissioned (see Section 7 "Commissioning", page 50).
- ☐ A computer with an Ethernet interface must be available.
- ☐ The Sunny Multigate must be connected to the network.
- ☐ Sunny Explorer from software version 1.06 must be installed on the computer.

Procedure:

- Start Sunny Explorer and create a PV system (see Sunny Explorer user manual at www.SMA-Solar.com).

8.4 Changing the System Time and System Password

To protect the inverter against unauthorized access and administer the PV system correctly, change the standard system password and the system time by means of Sunny Explorer (for further information refer to the manual or help of the Sunny Explorer).

Requirements:

- ☐ The PV system must be commissioned (see Section 7 "Commissioning", page 50).
- ☐ A computer with an Ethernet interface must be available.
- ☐ Sunny Explorer from software version 1.06 must be installed on the computer.
- ☐ The system must be registered in Sunny Explorer.

Procedure:

1. Access the Sunny Explorer user interface.
2. Change the standard password of the PV system. This will protect your PV system from unauthorized access.
3. Change the PV system time.

8.5 Changing Operating Parameters

By default, the inverter is set to a specific country data set. You can find the country data set to which the inverter has been set on the enclosed Production Test Report or on the type label. Each country data set contains various operating parameters, which can be individually set according to the respective country. After commissioning, you can change the parameters in Sunny Explorer.

Requirements:

- ☐ The PV system must be commissioned (see Section 7 "Commissioning", page 50).
- ☐ A computer with an Ethernet interface must be available.
- ☐ Sunny Explorer from software version 1.06 must be installed on the computer.
- ☐ The system must be registered in Sunny Explorer.
- ☐ The changes to the grid-relevant operating parameters must be approved by the responsible grid operator.

Procedure:

1. Access the Sunny Explorer user interface.
2. Select and set the desired parameter.
3. Save settings.

8.6 Deactivating the Webconnect Function

Requirements:

- ☐ The PV system must be commissioned (see Section 7 "Commissioning", page 50).
- ☐ A computer with an Ethernet interface must be available.
- ☐ Sunny Explorer from software version 1.06 must be installed on the computer.

Procedure:

1. Access the Sunny Explorer user interface.
2. Under **Settings > External Communication**, select the parameter **Webconnect functionality switched on** and set to **No**.
3. Save settings.

8.7 Adjustable Parameters

You can change the following parameters for voltage and frequency monitoring in Sunny Explorer (see also user manual of Sunny Explorer at www.SMA-Solar.com).

Name	Value/range	Default value
Voltage monitoring median maximum threshold (Overvoltage/Fast)	240 V to 270 V	270.0 V
Voltage monitoring lower maximum threshold (Overvoltage/Slow)	240 V to 270 V	264.0 V
Voltage monitoring upper minimum threshold (Undervoltage/Slow)	120 V to 240 V	211.2 V
Voltage monitoring of median minimum threshold (Undervoltage/Fast)	120 V to 240 V	120.0 V
Voltage monitoring median max. threshold trip.-time (Overvoltage/Fast, maximum time)	0.1 s to 90.0 s	0.16 s
Voltage monitoring lower max. threshold trip. time (Overvoltage/Slow, maximum time)	0.1 s to 90.0 s	1.0 s
Voltage monitoring upper min. threshold trip. time (Undervoltage/Slow, maximum time)	0.1 s to 90.0 s	2.0 s
Voltage monitoring median min. threshold trip.-time (Undervoltage/Fast, maximum time)	0.1 s to 90.0 s	0.16 s
Frequency monitoring lower maximum threshold (Overfrequency)	50.0 Hz to 63.0 Hz	60.5 Hz
Frequency monitoring upper minimum threshold (Underfrequency)	45.0 Hz to 60.0 Hz	59.3 Hz
Frequency monitoring median minimum threshold (Underfrequency fast)	45.0 Hz to 60.0 Hz	57.0 Hz
Frq. monitoring lower max. threshold trip. time (Overfrequency, maximum time)	0.1 s to 90.0 s	0.16 s
Frq. monitoring upper min. threshold trip. time (Underfrequency, maximum time)	0.1 s to 300.0 s	0.16 s
Frequency monitoring median min. threshold trip. time (Underfrequency fast, maximum time)	0.1 s to 2.5 s	0.16 s

Limits of Accuracy for Adjustable Voltage and Frequency Trip Limit Settings

Name	Default Value
Limits of accuracy of voltage measurement	1.2%
Limits of accuracy of frequency measurement	0.05 Hz / 0.1%
Limits of accuracy of time measurement at nominal trip time	0.1%

9 Disconnecting the Inverter from Voltage Sources

NOTICE

Damage to the inverter due to moisture ingress

When the inverter is open, moisture can penetrate and cause damage to the inverter. The tightness is no longer intact and the function of the inverter cannot be guaranteed.

- **Never** open the inverter.

NOTICE

Destruction of the measuring device due to overvoltage

- Only use measuring devices with a DC input voltage range up to at least 600 V.

Prior to performing any work on the inverter, always disconnect it from all voltage sources as described in this section. Observe the given sequence. If you want to disconnect several inverters from voltage sources, you must repeat the following procedure for each inverter.

Procedure:

1. **⚠ DANGER**

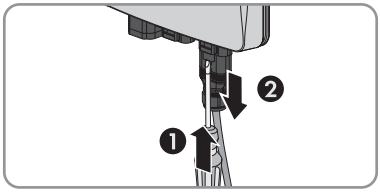
   Danger to life due to electric shock

   Do not disconnect under load

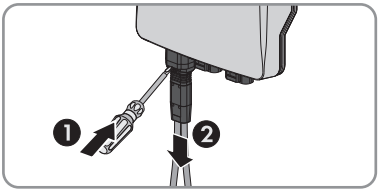
   PV plug connections must not be disconnected while under load. They can be placed in a no load state by switching off the DC/AC converter or breaking the AC circuit.

   - Disconnect the two-pole circuit breaker and secure against reconnection.
   - Cover the PV modules.

2. Release and remove all connected AC connectors from the inverter. Hook a flat-blade screwdriver (blade width: 4 mm (0.16 in.)) into the wide slot on the plug and lever it open. At the same time, pull out the AC connector without pulling the cable.

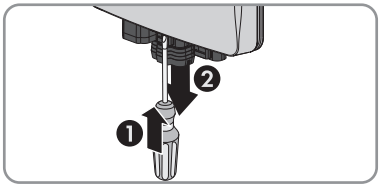


3. Release and remove the DC plug from the inverter. Hook a flat-blade screwdriver (blade width: 4 mm (0.16 in.)) into the wide slot on the plug and lever it open. At the same time, remove the DC plug without pulling the cables.



4. Make sure that no voltage is present at the DC pin connector on the inverter. Use a suitable measuring device.

5. Use a flat-blade screwdriver to remove the protective cap. Hook the flat-blade screwdriver (blade width: 4 mm (0.16 in.)) into the wide slot and lever it open. At the same time, pull out the protective cap.



6. **⚠ DANGER**

Risk of electric shock due to high voltages

- Before carrying out any of the following work, wait five minutes for the capacitors to discharge.

10 Disconnecting the Sunny Multigate from Voltage Sources

⚠ DANGER

Risk of electric shock due to contact with live components when opening the Sunny Multigate

There are live components inside the Sunny Multigate. There is a risk of electric shock if you open the Sunny Multigate.

- **Never** open the Sunny Multigate.

Before working on the Sunny Multigate, always disconnect it from all voltage sources as described in this section.

Procedure:

1. **⚠ DANGER**

   Danger to life due to electric shock

   - Disconnect the two-pole circuit breaker and secure against reconnection.
2. Ensure that no voltage is present at the AC terminal **Grid** between conductor L1 and the grounding conductor. Use a suitable measuring device.
3. Ensure that no voltage is present at the AC terminal **Grid** between conductor L2 and the grounding conductor. Use a suitable measuring device.
4. Ensure that no voltage is present at the AC terminal **Inverter** between conductor L1 and the grounding conductor. Use a suitable measuring device.
5. Ensure that no voltage is present at the AC terminal **Inverter** between conductor L2 and the grounding conductor. Use a suitable measuring device.

11 Troubleshooting

11.1 LED Signals on the Sunny Multigate

The LEDs on the Sunny Multigate indicate the operating state of the PV system.

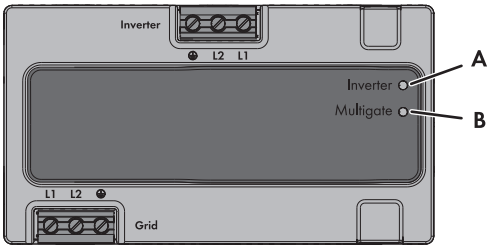


Figure 20: Position of the LEDs on the Sunny Multigate

The upper LED is labeled with **Inverter** and indicates the operating state of the inverters.
The lower LED is labeled with **Multigate** and indicates the operating state of the Sunny Multigate.

LED	Status	Explanation
A: LED **Inverter**	Off	The communication with the inverters is not active.
	glowing green	The inverters are in operation.
	glowing orange	At least one of the connected inverters is in **Warning** mode. You will find the detailed error message in Sunny Portal or Sunny Explorer. If communication is still possible, determine the respective error message in Sunny Portal or Sunny Explorer.
	glowing red	At least one of the connected inverters is in **Fault** mode. You will find the detailed error message in Sunny Portal or Sunny Explorer. You can find the cause and its corrective measure in this document (see Section 11.2, page 61).

LED	Status	Explanation
B: LED **Multigate**	Off	Either there is no AC voltage present or the Sunny Multigate is defective.
	glowing green	The Sunny Multigate is in normal operating state.
	glowing orange	The Sunny Multigate is in **Warning** mode. 1. If communication is still possible, determine the respective error message in Sunny Portal or Sunny Explorer. You can find the cause and its corrective measure in this document (see Section 11.2, page 61). 2. If no communication is possible, disconnect the network cable from the Sunny Multigate and reconnect the Sunny Multigate to the network (see Section 8.1, page 52). 3. If the error persists, disconnect the Sunny Multigate from any voltage source (see Section 10, page 59) and reconnect it Connecting the Sunny Multigate to the Utility Grid. 4. If the error persists, contact the SMA Service Line.
	glowing red	The Sunny Multigate is in **Fault** mode. 1. If communication is still possible, determine the respective error message in Sunny Portal or Sunny Explorer. You can find the cause and its corrective measure in this document (see Section 11.2, page 61). 2. If no communication is possible, disconnect the network cable from the Sunny Multigate and reconnect the Sunny Multigate to the network (see Section 8.1, page 52). 3. If the error persists, disconnect the Sunny Multigate from any voltage source (see Section 10, page 59) and reconnect it Connecting the Sunny Multigate to the Utility Grid. 4. If the error persists, contact the SMA Service Line.

11.2 Events: Information, Warnings and Errors

During operation of the PV system, events may occur which can refer to one or several inverters or the Sunny Multigate. Events can be information, warnings or errors. All events are displayed in the communication product you are using (e.g. Sunny Portal, Sunny Explorer). Sunny Explorer additionally displays the corresponding event number for each event.

Inverter

Event number	Event, cause and corrective measures
102	**Grid fault / Grid overvoltage fast (102)** The line voltage or grid impedance at the connection point of the inverter is too high. The inverter has disconnected from the utility grid. **Corrective measures:** • Check whether the line voltage at the connection point of the inverter is permanently in the permissible range. If the line voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must approve changes to the operating parameters of the inverter. If the line voltage is permanently within the permissible range and this message is still displayed, contact the SMA Service Line.
202	**Grid fault / Grid undervoltage fast (202)** The utility grid has been disconnected, the AC cable is damaged or the line voltage at the connection point of the inverter is too low. The inverter has disconnected from the utility grid. **Corrective measures:** 1. Make sure that the circuit breaker is switched on. 2. Make sure that the AC cable is not damaged. 3. Make sure that the AC cable is correctly connected. 4. Check whether the line voltage at the connection point of the inverter is permanently in the permissible range. If the line voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must approve changes to the operating parameters of the inverter. If the line voltage is permanently within the permissible range and this message is still displayed, contact the SMA Service Line.
301	**Grid fault / Voltage increase protection (301)** The line voltage or grid impedance at the connection point is too high. The inverter disconnects from the utility grid to comply with the power quality. **Corrective measures:** • Check whether the line voltage at the connection point of the inverter is permanently in the permissible range. If the line voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must approve changes to the operating parameters of the inverter. If the line voltage is permanently within the permissible range and this message is still displayed, contact the SMA Service Line.

Event number	Event, cause and corrective measures
401	**Grid fault / Island grid (401)** The inverter is no longer in grid parallel operation and has stopped feed-in operation for safety reasons. **Corrective measures:** • Check the grid connection for significant, short-term frequency fluctuations.
501	**Grid fault / Grid frequency disturbance (501)** The power frequency is not within the permissible range. The inverter has disconnected from the utility grid. **Corrective measures:** • If possible, check the power frequency and observe how often major fluctuations occur. If fluctuations occur frequently and this message is displayed often, contact the grid operator. The grid operator must approve changes to the operating parameters of the inverter. If the grid operator gives his approval, discuss any changes to the operating parameters with the SMA Service Line.
3401	**DC overvoltage / Overvoltage input A (SW) (3401)** The DC input voltage connected to the inverter is too high. This can destroy the inverter. **Corrective measures:** 1. Immediately disconnect the PV module from the inverter. 2. Check whether the DC voltage is below the maximum input voltage of the inverter. If the DC voltage is below the maximum input voltage of the inverter, reconnect the DC connectors to the inverter. If the DC voltage is above the maximum input voltage of the inverter, ensure that the PV array has been correctly rated or contact the installer of the PV array. If this message is repeated frequently, contact the SMA Service Line.
3501	**Insulation resistance / Insulation failure (3501)** The inverter has detected a ground fault in the PV array. As long as the fault exists, the inverter will not feed in. **Corrective measures:** • Check the PV system for ground faults (see Section 11.3, page 67).

Event number	Event, cause and corrective measures
3902	**Waiting for DC start conditions / Generator voltage too low / Start conditions not met (3902)** The PV array voltage is too low. **Corrective measures:** 1. Wait until the level of solar irradiation has increased. 2. If necessary, remove snow or dirt from the PV modules.
3903	**Waiting for DC start conditions / Generator voltage too high / Start conditions not met (3903)** The PV array voltage is too high. **Corrective measures:** • Wait until the DC start conditions are met.
6002 to 6006	**Self diagnosis > Interference of device (6002, 6005, 6006)** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
6305	**Self diagnosis > Interference of device (6305)** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
6402	**Self diagnosis / Overtemperature (6402)** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
6406	**DC overcurrent / Overcurrent input A (HW) (6406)** The current at the module input of the inverter is too high. The inverter has interrupted the feed-in operation. **Corrective measures:** • Check whether the line voltage at the connection point of the inverter is permanently in the permissible range and/or whether voltage jumps occur (e.g. by switching on and off large loads). If voltage jumps occur or the line voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must approve changes to the operating parameters of the inverter. If the line voltage is permanently within the permissible range and this message is still displayed, contact the SMA Service Line.

Event number	Event, cause and corrective measures
6415	**Self diagnosis > Interference of device (6305)** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
6450	**Self diagnosis / Energy transfer not possible / Interference device (6450)** The inverter cannot feed into the utility grid. Possible causes: line voltage is too high; a PV module is defective, soiled or shaded; a cloudy or foggy day. **Corrective measures:** 1. Check whether the line voltage at the connection point of the inverter is permanently in the permissible range. If the line voltage is outside the permissible range due to local grid conditions, contact the grid operator. The grid operator must approve changes to the operating parameters of the inverter. 2. Check whether the DC voltage is stable in a realistic range in accordance with the datasheet of the PV module and the assessment of the weather situation. Therefore, determine the voltage during inverter operation using a communication product. 3. Check whether the respective PV module is heavily soiled or shaded. Clean the PV module if soiled. 4. On extremely cloudy or foggy days, wait for higher solar irradiation. 5. If none of the described causes is applicable and the message is still displayed, contact the SMA Service Line.
10265	**PLC communication impaired (10265)** The cause must be determined by the SMA Service Line. **Corrective measures:** 1. If several Sunny Multigate devices are installed in a PV system, check whether the AC cables from the inverters to the Sunny Multigate devices have been laid in separate channels. If the AC cables are not laid separately from each other, do lay the AC cables from the inverter to the Sunny Multigate in separate locations. 2. If the problem persists, contact the SMA Service Line.

Sunny Multigate

Event number	Event, cause and corrective measures
6702	**Interference device (6702)** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.

Event number	Event, cause and corrective measures
7001	**Fault sensor interior temperature (7001)** The temperature sensor for the indoor temperature of the Sunny Multigate is defective. Feed-in operation will be interrupted. **Corrective measures:** • Contact the SMA Service Line.
8101 to 8102	**Communication disturbed (8101, 8102)** An error has occurred in the internal communication. This can be caused by one of the following: Feed-in operation continues. **Corrective measures:** 1. If several Sunny Multigate devices are installed in a PV system, check whether the AC cables from the inverters to the Sunny Multigate devices have been laid in separate channels. If the AC cables are not laid separately from each other, do lay the AC cables from the inverter to the Sunny Multigate in separate locations. 2. If the problem persists, contact the SMA Service Line.
8104	**Interference device (8104)** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.
9014	**Invalid device combination (9014)** The Sunny Multigate and the inverters cannot be operated in this combination. **Corrective measures:** • Contact the SMA Service Line and request the latest firmware package, if necessary.
9015	**Max. permitted number of inverters exceeded (9015)** The number of inverters connected exceeds the number specified in the currently set standard. **Corrective measures:** • Reduce the number of inverters in the PV system until the maximum permissible number is reached (see user manual of the communication product).
10221	**New device cannot be administered (10221)** The cause must be determined by the SMA Service Line. **Corrective measures:** • Contact the SMA Service Line.

Event number	Event, cause and corrective measures
10259	**Inconsistent communication version (10259)** The communication version of an inverter is not supported or the device combination is invalid. **Corrective measures:** • Contact the SMA Service Line and request the latest firmware package, if necessary.
10265	**The device with serial number X has not been available for X day(s) (10265)** Communication with one or several inverters is no longer possible. **Corrective measures:** 1. Check cables and inverters for loose connectors or damage. 2. Check PV modules for soiling or damage. 3. If the problem persists, contact the SMA Service Line.
10267	**Loss of communication to one or several devices (10267)** Communication with one or several inverters is no longer possible. **Corrective measures:** 1. Check cables and inverters for loose connectors or damage. 2. Check PV modules for soiling or damage. 3. If the problem persists, contact the SMA Service Line.

11.3 Checking the PV System for Ground Faults

If the LED **Inverter** on the Sunny Multigate is glowing red, this may indicate a ground fault in the PV system. The electrical insulation between the PV system and ground is defective.

⚠ WARNING

Danger to life due to electric shock

In the event of a ground fault, high voltages can be present.

- **No** terminal of the PV module must be grounded.
- Only touch the cables of the PV modules on their insulation.
- Do not touch any parts of the framework or supports of the PV modules.
- Do not connect PV modules with ground faults to the inverter.

NOTICE

Destruction of the measuring device due to overvoltage

- Only use measuring devices with a DC input voltage range up to at least 600 V.

If the Sunny Multigate indicates a ground fault in the PV array, proceed as follows:

Procedure:

1. Make sure that **no** terminal of the PV module is grounded.
2. Use Sunny Portal or Sunny Explorer to determine which of the connected inverters has a ground fault (see user manual of the communication product at www.SMA-Solar.com).
3. **⚠ DANGER**

   Risk of electric shock due to high voltages

   - Disconnect the affected inverter from any voltage source (see Section 9, page 57).
4. Measure voltages with a suitable measuring device.
   - Measure the voltages between the positive terminal and the ground potential.
   - Measure the voltages between the negative terminal and the ground potential.
   - Measure the voltages between the positive and negative terminals.

   If the following results are present at the same time, there is a ground fault in the PV system.
   - All measured voltages are stable.
   - The sum of the two voltages to ground potential is approximately equal to the voltage between the positive and negative terminals.
   - Eliminate the ground fault.

   If there is no ground fault and the problem persists, contact the SMA Service Line.
5. Commission the PV system (see Section 7 "Commissioning", page 50).

12 Decommissioning

12.1 Decommissioning the Inverter

1. **⚠ DANGER**

   Danger to life due to electric shock

   Do not disconnect under load

   PV plug connections must not be disconnected while under load. They can be placed in a no load state by switching off the DC/AC converter or breaking the AC circuit.

   - Disconnect the inverter from all voltage sources (see Section 9, page 57).

2. Release and remove all cables from the inverter.
3. Loosen all screws in the drill holes.
4. Remove the inverter from the wall or profile rail.
5. If the inverter is to be stored or shipped in packaging, pack the inverter, the DC connectors, and the AC connector. Use the original packaging or packaging that is suitable for the weight and dimensions of the inverter (see Section 13 "Technical Data", page 71).
6. Dispose of the inverter in accordance with the locally applicable disposal regulations for electronic waste.

12.2 Decommissioning the Sunny Multigate

1. **⚠ DANGER**

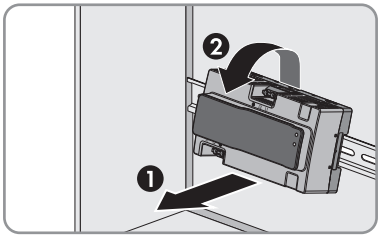
   Danger to life due to electric shock

   Do not disconnect under load

   PV plug connections must not be disconnected while under load. They can be placed in a no load state by switching off the DC/AC converter or breaking the AC circuit.

   - Disconnect the inverter from all voltage sources (see Section 9, page 57).

2. Release the screw terminals on the Sunny Multigate using a flat-blade screwdriver (blade width: 3.5 mm).
3. Remove the conductors L1 and L2 from both connecting terminal plates.
4. If a network cable is connected, pull the network cable out of the pin connector.
5. Pull the grounding conductor out of both connecting terminal plates.
6. Disassemble the Sunny Multigate:
   - If mounted on a top-hat rail, detach the Sunny Multigate from the top-hat rail. Tilt the lower edge of the Sunny Multigate forwards and lift it up and off the top-hat rail.



- If mounted on the brackets, release the screws with a flat-blade screwdriver (blade width: 3.5 mm) and remove the Sunny Multigate.

7. If the Sunny Multigate is to be stored or shipped, pack the Sunny Multigate and the AC connector. Use the original packaging or packaging suitable for the weight and size of the Sunny Multigate (see Section 13 "Technical Data", page 71).
8. If the Sunny Multigate is to be disposed of, dispose of the Sunny Multigate in accordance with the locally applicable disposal regulations for electronic waste.

13 Technical Data

13.1 Sunny Boy 240-US

DC Input

Maximum number of connected PV modules per inverter	1
Maximum DC power at cos φ = 1	250 W
Maximum input voltage	45 V
MPP voltage range at 240 V	23.0 V to 32.0 V
Operating range at 240 V	23.0 V to 40.0 V
Rated input voltage	29.5 V
Minimum input voltage	23.0 V
Minimum initial input voltage	23.0 V
Maximum initial input voltage	40 V
Maximum input current	8.5 A
Maximum input current per string	8.5 A
Maximum short-circuit current per module	12 A
Maximum backfeed current to input source	0 A
Number of independent MPP inputs	1
Strings per MPP input	1

AC Output

Rated power at 240 V, 60 Hz	240 W
Maximum apparent AC power	240 VA
Rated grid voltage	240 V
Nominal AC voltage*	2 x 120 V
AC voltage range	211 V to 264 V
Nominal AC current at 2 x 120 V	1 A
Maximum output current	1 A
Total harmonic distortion of the output current with total harmonic distortion of the AC voltage < 2 %, and AC power > 50 % of the rated power	≤ 3 %
Maximum output fault current	241 A

Maximum output duration	3.18 ms
Line synchronization characteristics	Type 2
Line synchronization in-rush current	123 mA
Rated power frequency	60 Hz
AC power frequency	60 Hz
Operating range at AC power frequency 60 Hz	59.3 Hz to 60.5 Hz
Limits of accuracy of voltage measuremet	1.2 %
Limits of accuracy of frequency measurement	0.05 Hz / 0.1 %
Limits of accuracy of time measurement at nominal trip time	0.1 %
Maximum power temperature range	−40 °C to +65 °C (−40 °F to +149 °F)
Temperature for output power temperature derating	No derating
Power factor at rated power	1
Feed-in phases*	2
Connection phases*	2
Overvoltage category with Sunny Multigate	IV

* 2 x 120 V split phase

Protective Devices

DC reverse polarity protection	Short-circuit diode
Grid monitoring	SMA Grid Guard 5
AC short-circuit current capability	Available
Ground-fault monitoring	Insulation Monitoring
Galvanic isolation	Available

General Data

Width x height x depth, without connection area	188 mm x 199 mm x 43 mm (7.40 in. x 7.83 in. x 1.69 in.)
Width x height x depth, with connection area	188 mm x 218 mm x 43 mm (7.40 in. x 8.58 in. x 1.69 in.)
Weight	1.3 kg (2 lbs 13 oz.)
Operating temperature range	−40 °C to +65 °C (−40 °F to +149 °F)
Maximum power temperature range	−40 °C to +65 °C (−40 °F to +149 °F)
Storage temperature	−40 °C to +70 °C (−40 °F to +158 °F)

Temperature for temperature derating of output power	No derating
Maximum permissible value for relative humidity, non-condensing	100 %
Maximum operating altitude above mean sea level	3000 m (9840 ft.)
Noise emission, typical	≤ 38 dB(A)
Power loss in night mode	< 0.03 W
Topology	HF transformer
Cooling concept	Convection
Degree of protection in accordance with UL50E	Type 4X
Protection class	I
Approvals and national standards, as per 09/2013	UL1741, UL1998, IEEE 1547, FCC Part 15 (Class A & B), CAN/CSA C22.2 No. 107.1-1

Features

DC connection	DC plug with DC connector*: DC plug, assembled, MC4 (US), DC plug, assembled, Tyco (US)
AC connection	AC cable with two connectors**
Powerline interface	As standard

* The DC connectors supplied depend on the order (for SMA order numbers of the DC connectors (see Section 14 "Accessories", page 76)).

** The length of the AC cable is either 1.40 m (4.6 ft.) or 2.0 m (6.6 ft.), depending on the order option.

Torques

Screw for grounding	3.5 Nm (31 in-lb)

Grid configurations

Split phase	Suitable
Autotransformer*	Limited suitability

* When using autotransformers, take into account that the voltages of L1 to the grounding conductor and L2 to the grounding conductor are – in no-load operation as well as under load – within the permissible range and symmetrical. If the voltages are not symmetrical, the inverters are not damaged, but they also do not feed in. The PV system can therefore not be operated on this transformer.

Efficiency

Maximum efficiency, η_{max}	95.9 %
CEC efficiency, η_{CEC}	96.0 %

13.2 Sunny Multigate-US

AC Input

Maximum number of connected micro inverters	12
Minimum number of connected micro inverters	1
Maximum input current	12 A

AC Output

Rated power at 240 V, 60 Hz	2,880 W
Rated grid voltage	240 V
Nominal AC voltage*	2 x 120 V
AC voltage range	211 V to 264 V
Nominal AC current at 240 V	12 A
Maximum output current	12 A
Total harmonic distortion of the output current with total harmonic distortion of the AC voltage < 2%, and AC power > 50% of the rated power	≤ 3 %
Rated power frequency	60 Hz
AC power frequency	60 Hz
Operating range at AC power frequency 60 Hz	59.3 Hz to 60.5 Hz
Power factor at rated power	1
Feed-in phases*	2
Connection phases*	2
Overvoltage category	IV

* 2 x 120 V split phase

Protective Devices

Overvoltage Protection	Varistors
Maximum permissible fuse protection	15 A

General Data

Width x height x depth, without connection area	162 mm x 90 mm x 68 mm (6.38 in. x 3.54 in. x 2.68 in.)
Weight	0.75 kg (1.65 lbs)
Operating temperature range	−40°C to +45°C (−40°F to +113°F)
Storage temperature	−40 °C to +70 °C (−40 °F to +158 °F)

Maximum permissible value for relative humidity, non-condensing	100 %
Maximum operating altitude above mean sea level	3000 m (9840 ft.)
Cooling concept	Convection
Industrial enclosure for indoor use: degree of protection complying with UL50E	Type 1
Industrial enclosure for outdoor use: degree of protection complying with UL50E	Type 3
Protection class	I
Pollution degree	3
Approvals and national standards, as per 09/2013	UL1741, IEEE 1547, FCC Part 15 (Class A & B), CAN/CSA C22.2 No. 107.1-1

Features

Power-line communication to inverters	As standard
Speedwire/Webconnect communication to SMA communication products, RJ45	As standard
Display of the PV system and communication status	2 LEDs

Torques

Screw terminals	0.6 Nm (5.31 in-lb)

Data Storage Capacity

Energy yield over the day per inverter	At least 63 days
Daily yields per inverter	At least 30 years
Event messages of the Sunny Multigate for users	At least 1024 events
Event messages of the Sunny Multigate for installers	At least 1024 events
Event messages per inverter for users	At least 256 events
Event messages per inverter for installers	At least 256 events

13.3 Torques of AC Field Plugs

Screw in insulator	0.8 Nm (7 in-lb)
Nut of the AC plug enclosure (initial torque)	3.3 Nm (29.2 in-lb)
Nut of the AC plug enclosure (end torque)	5.1 Nm (45.1 in-lb)

14 Accessories

You will find the corresponding accessories and spare parts for your product in the following overview. If required, these can be ordered from SMA or your distributor.

Designation	Brief description	SMA order number
DC plug, assembled, MC4 (US)	24 DC plugs, assembled, Multi-Contact KST4 Multi-Contact USA, type KST4/2.5II-UR (male) / type PV-KBT4/2.5II-UR (female), AWG 14, maximum rated 600 V DC, 30 A DC	MI-DCMC4-US-10
DC plug, assembled, Tyco (US)	24 DC plugs assembled with Tyco Solarlock Tyco Electronics AMP GmbH, type 1394461 (male) / type 1394462 (female), AWG 14, rated maximum 600 V DC, 25 A DC	MI-DCTYCO-US-10
AC field plug (US)	20 AC field plugs	ACCON-US-10
AC protective cap	200 AC protective cap	MI-ACCAP-US-10
AC cable 1.40 m (4.6 in.)	24 AC cables with counterplugs for connecting the inverters among each other	MI-ACCAB14-US-10
AC cable 2.0 m (6 ft.)	24 AC cables with counterplugs for connecting the inverters among each other	MI-ACCAB20-US-10
Cable for AC field plug 100 m (328 ft.)	AC cables for connecting the inverters to the Sunny Multigate	MG-ACCAB100-US-10
Cable for AC field plug 200 m (656 ft.)	AC cables for connecting the inverters to the Sunny Multigate	MG-ACCAB200-US-10
Cable for AC field plug in accordance with UL6703	UL listed with +90 °C (+194 °F) wet/dry rating, approval (UL 184) Manufacturer: LAPP USA	Lapp–Tray Cable II A 3G AWG 14⁄46 BK cULus Listed QPOR TCER cable
Bootlace ferrules 14 AWG (UL-listed)	Manufacturer: Miromar LLC	Distributor: Ferrules Direct Order no. N25010
Cable shears	Insulated handles, 165 mm (6.5 in.) Manufacturer: KNIPEX	via distributor Art. no. 95 16 165
Stripping knife with straight knife blade	TiN 8 mm to 28 mm (0.32 in. to 1.10 in.) Manufacturer: JOKARI	via distributor Art. no. 728000

Designation	Brief description	SMA order number
Insulation stripping tool	Stripping diameter up to AWG 10 (7 mm²), insulation stripping length up to 25 mm (1 in.) Manufacturer: WEIDMÜLLER	via distributor Order no. 9005000000
Crimping tool	Square crimping tool for bootlace ferrules up to 10 mm² (7 AWG) Manufacturer: RENNSTEIG	via distributor Art. no. 610 084 3
Torque screwdriver	1.4" hexagon socket, 0.3 Nm to 1.2 Nm (2.7 in-lb to 10.6 in-lb) Manufacturer: WERA	via distributor Art. no. 05074700001
Screwdriver bit	1.4" hexagon, length: 25 mm (1 in.) Application: cross-head screws Manufacturer: WERA	via distributor Art. no. 05056422001
Torque wrench	Adjustable by scale, Torque range: 2 Nm to 20 Nm (17.7 in-lb - to 177 in-lb) Manufacturer: STAHLWILLE	via distributor Art. no. 50181002
Crow-Ring wrench, AF 25	Manufacturer: STAHLWILLE	via distributor Art. no. 02190025
Square insertion tool	Outer square: 10 mm (0.38 in.) Inner square: 9 x 12 mm (0.36 x 0.47 in.) Manufacturer: STAHLWILLE	via distributor Art. no. 58240005 (734/5)
Screwdriver	Insulated Blade width: 4 mm (0.16 in.) Blade thickness: 0.8 mm (0.03 in.) Manufacturer: WERA	via distributor Art. no. 05006115006

15 Compliance Information

FCC Compliance

This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

The user is cautioned that changes or modifications not expressly approved by SMA America, LLC could void the user's authority to operate this equipment.

IC Compliance

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

16 Contact

If you have technical problems concerning our products, contact the SMA Service Line. We need the following information in order to provide you with the necessary assistance:

- Inverter device type
- Device type of the Sunny Multigate
- Type and number of PV modules connected
- Type of communication
- Warning or error

United States/ Estados Unidos	SMA America, LLC Rocklin, CA	Toll free for USA, Canada and Puerto Rico / Llamada gratuita en EE. UU., Canadá y Puerto Rico: +1 877-MY-SMATech (+1 877-697-6283) International / Internacional: +1 916 625-0870
Canada/ Canadá	SMA Canada, Inc. Toronto	Toll free for Canada / gratuit pour le Canada: +1 877-MY-SMATech (+1 877-697-6283)

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